ANKLE AND FOOT INJURIES: PREVALENCE, SELECTED ASSOCIATED FACTORS AND THEIR EFFECT ON FUNCTION AMONG PREMIERE LEAGUE SOCCER PLAYERS IN GABORONE

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Kaelo Kgosiyang

Student number: 1445646

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DECLARATION

I, Kaelo Kgosiyang, hereby declare that the work presented in this research report is mine. It is being submitted in partial fulfilment of the Degree of Master of Science in Physiotherapy to the University of the Witwatersrand, Johannesburg. The report has not been submitted before for any degree or examination at this or any other university.

Signature----------

Date----------

DEDICATION

To the almighty God for the strength to carry on;

To my family, especially my children Tlotso and Tlatso, for their support.

Abstract

Background: Soccer has been described as the most popular sport globally that comes with high performance expectations. This can lead to increased risk of injuries such as ankle and foot injuries. Studies on injuries in soccer teams from under-resourced places like Gaborone, Botswana are scanty.

Aim: To determine the prevalence of ankle and foot injuries and their effect on function and activity on premiere league soccer players in Gaborone.

Method: A cross sectional descriptive study was conducted on 109 soccer players. A foot and ankle outcome score questionnaire was used to assess the effect of the injury on function and activity. An assessment of foot posture was carried out on each player. Results were analysed using Stata version 15.1.

Results: The sample consisted of male premiere league soccer players ranging from 18-32 years with a median age of 24 years (IQR 22-26). Prevalence of ankle and foot injury was 46.80% with the majority of the injured players being midfielders (23.85%). Previous history of ankle and foot injury was reported by 66.7% of the participants. A significant association was found between playing position and previous history of ankle and foot injury (p= 0.02). A significant strong positive correlation was reported between pain and activities of daily living$(r_{s=}0.74, p = 0.00)$.

Conclusion: The results show that soccer players in Gaborone are at risk of incurring ankle and foot injury during training and matches. The study highlights the importance of putting in place stringent injury prevention measures to curb the prevalence of ankle and foot injuries.

Key words: Ankle injury, foot injury, ankle AND foot injury, injury prevalence, risk factors, management, rehabilitation, injury prevention

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TABLE OF CONTENTS

Table of Contents

List of tables

LIST OF FIGURES

1. CHAPTER ONE: INTRODUCTION

1.1 Background

Soccer is one of the most popular sport globally. The high expectations by the fans and the soccer team management can lead to increased risk of injuries such as ankle and foot injuries (Azubuike and Okojie, 2009). Incurred Injuries by soccer players can greatly affect the performance, morale, and results of a team which will, in turn, have an effect on the financial state of the team (Woods et al., 2002). Thus, injury prevention and control measures are essential for soccer players and team wellbeing (Hawkins et al., 2001).

The prevalence of injuries in soccer players is significant. Walden 2012 collected data from 14 Europeans professional men's football clubs and registered a total of 4483 injuries. From these injuries, 625 (14%) were ankle injuries (with 7% being ankle sprain) while 268 (6%) were foot or toe injuries. Similar reports were highlighted by Azubuike and Okojie (2009). The study found that the most common soccer-related injuries were ankle sprains (33%). Worth noting is the finding that the prevalence of soccer injuries increased as the level of participation increased. Hundred percent of players in the professional and premiership leagues experienced soccer-related injuries compared to 78% in the state amateur league. This shows that as soccer players progress in their soccer career they will be vulnerable to experiencing soccer-related injuries Therefore, regular injury screening is essential to inform the development of prevention intervention.

There are various risk factors which predispose soccer players to ankle and foot injuries. Studies that have looked at foot and ankle injuries have highlighted age; foot type and size; previous ankle sprain, joint laxity, ankle instability; weight, height; muscle strength; limb dominance; type of field of play; use of orthosis or taping; type of shoes used by players; intensity of match and position of play to be key risk factors (Ekstrand et al., 2011, Halabchi et al., 2016, Henry et al., 2016). However, it is difficult to make a conclusion with regard to risk factors associated with ankle and foot injuries and this calls for context based studies for better identification of injury risk factors.

1.2 Problem statement

Several studies have found that ankle injuries are prevalent in soccer players. Studies on soccer injuries in soccer teams from under-resourced places like Gaborone, which use dirt field as their training ground and only use grass or turf for matches are scanty. In addition, the proposed risk factors for ankle injuries remain controversial. More studies are needed to identify possible risk factors in order to plan prevention strategies to reduce ankle and foot injuries.

1.3 Research question

What is the prevalence of ankle and foot injuries, selected associated risk factors and their effect on activity and function among premiere league soccer players in Gaborone?

1.4 Aim of the study

To determine the prevalence of ankle and foot injuries, selected associated risk factors and their effect on activity and function among premiere league soccer players in Gaborone.

1.5 Objectives of the study

1. To determine the prevalence of ankle and foot injuries within half a season among premiere league soccer players in Gaborone.
2. To establish the extent of ankle and foot symptoms of pain experienced by players.
3. To determine associated risk factors of ankle and foot injuries.
4. To determine the association between ankle and foot injuries and difficulty with activities of daily living.
5. To determine the association between ankle and foot injuries and difficulty with sports and recreation.

1.6 Significance of the study

Currently, there is no study on the prevalence of ankle and foot injuries, associated risk factors and their effect on activity and function amongst soccer players in Botswana. Premiere league teams in Gaborone are under resourced in terms of playing fields and medical personnel. Though teams have medical personnel who treat

soccer players when they are injured, they do not have medical personnel working with them on full time basis. This makes injury management and proper rehabilitation difficult. By doing this study, the body of knowledge on the prevalence of ankle and foot injuries, risk factors and understanding their effect on activity and function in the local population will be established. The study can be used as a basis for the development of injury prevention strategies for premiere league teams in Gaborone.

1.7 Summary

Ankle injuries have been found to be prevalent among soccer players, however, there has been a controversy with regard to ankle injury risk factors. This chapter outlined the problem statement, research questions, study objectives and the significance of the study. The next chapter will review the relavant literature.

2 CHAPTER TWO

2.1 Introduction

This chapter aims to review the current literature on ankle and foot soccer injuries. The review will explore the following headings: the burden of foot and ankle injuries globally and in Africa; common ankle and foot injuries; the structure and function of the ankle/foot complex; mechanism of injuries; diagnosis and management of ankle and foot injuries; predisposing factors; the effect of injury on activity and function and prevention of ankle and foot injuries. . The search engines used for this review were EBSCO HOST, PubMed, Cochrane databases and Science Direct.
Keywords used were: ankle injury, foot injury, ankle AND foot injury, injury prevalence, risk factors, management, rehabilitation, injury prevention

2.2 Ankle and Foot injuries

Ankle and foot injuries may be defined as damage to the bony and ligamentous structures in the foot and ankle (Moore et al., 2013) This injury is usually associated with pain, swelling, redness and joint instability (Wright et al., 2000, Nunley and Vertullo, 2002). Some studies report of ankle and foot injury as a collective (Jacobs and Van Den Berg, 2012, Jones et al., 2019) and those that group the injuries and report as either ankle injuries (Morgan and Oberlander, 2001) or foot injuries (Archary, 2008). For the purpose of this study, the injuries are grouped together and reported as ankle and foot injuries. Different definitions of soccer injury have been used in the literature. For the purpose of this study, the definition of injury used was adopted from the study by Kofotolis et al. (2007) as “soccer injury is one sustained during training or competition that prevented the injured player from participating in matches or training sessions”.

2.3 The burden of ankle and foot injuries

The burden of ankle and foot injuries have been reported to be significant. Ekstrand (2008) looked at the epidemiology of injuries in male professional football competing in the union of European football associations (UEFA) champions league (UCL) and the Swedish super league. The study reported the prevalence of ankle injury to be 13%. Similarly, a current study by Jones et al. (2019) looked at the epidemiology of

injuries in English professional football players competing in the English football league and national conference and reported the prevalence of ankle injury as 13% and the prevalence of foot and toe injuries as 3%. This shows that soccer players are prone to ankle and foot injuries and regular screening is imperative.

Higher prevalence rates on ankle and foot injury have been highlighted in African countries. A cross-sectional study by Jacobs and Van Den Berg (2012) looked at 169 elite male African soccer players aged 14 to 18 years from eleven African countries and reported foot and ankle injury prevalence of 3% and 21% respectively. Even higher prevalence rates have been reported in previous studies on soccer-related injuries. Twizere (2004) conducted a study on the epidemiology of soccer injuries in Rwanda and reported a higher ankle injury prevalence ranging between 35%-42% in the first and second division leagues respectively. Related to foot injuries, a descriptive study based in South Africa, on the profile of soccer injuries in selected league amateur indoor and outdoor soccer players in the greater Durban area reported a high prevalence of foot injuries (62.1%) (Archary, 2008).These studies indicate that ankle and foot injuries in soccer players in African countries are prevalent, at even higher rates than in developed countries. To develop targeted prevention strategies for ankle and foot injuries, it is essential to collect context surveillance data.

2.4 Common ankle and foot injuries

There are various types of soccer-related ankle and foot injuries. The most commonly reported ankle injury is the ankle sprain (Kofotolis et al., 2007, Waldén et al., 2013). A study by Kofotolis et al. (2007) who looked at ankle sprain injuries and risk factors in amateur soccer players reported ankle sprains as most common injury with ankle ligament injuries accounting for 66.8% of all injuries. Majority of players present with some sort of injury to the lateral ligament complex involving the calcaneo-fibular, anterior-fibula or posterior-talofibular ligaments (Kofotolis et al., 2007). Lateral ankle ligament sprains account for three quarter of the sprains followed by high syndesmotic injuries accounting for only 5% (Waldén et al., 2013). Lievers and Adamic (2015) looked at the incidence and severity of foot and ankle injuries in men's collegiate American football and reported lateral ankle ligament sprains, syndesmotic sprains,

medial ankle ligament sprains, midfoot injuries and first metatarsophalangeal joint sprains as the five most common injuries accounting for 81% of all foot and ankle injuries.

2.5 Anatomy of ankle and foot

Knowledge of the anatomy of the foot is key to understanding injury which makes it easier to come up with treatment plan and prevention strategies (Fong et al., 2009). The ankle joint is made up of three articulations being subtalar joint, distal tibiofibular syndesmosis and talo-crural joint (Hertel, 2002).

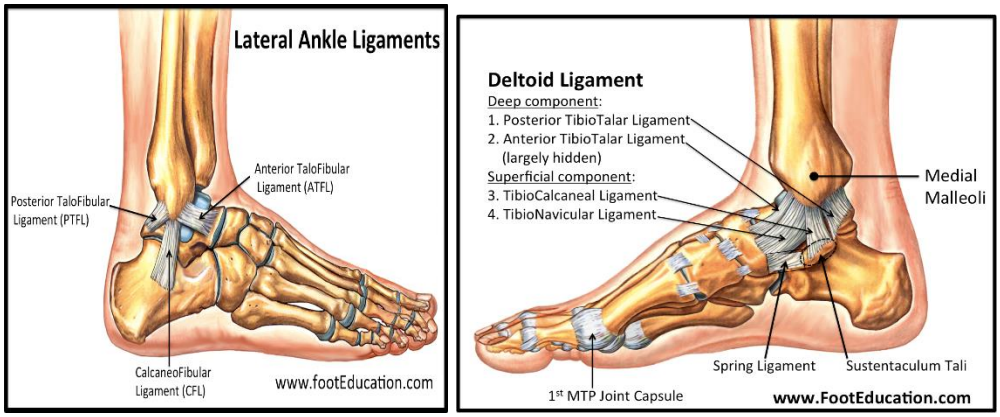

Figure 2.1: Ankle joint and ligaments

Source: https://www.footeducation.com/page/ligaments-of-foot-and-ankle-overview

The talocrural joint is formed by the articulation between the talus and the tibia/fibula (medial malleolus, lateral malleolus and tibial plafond) (Wu et al., 2002, Hertel, 2002). Ligaments that offer support and stabilize the talocrural joint (figure 2.1) are calcaneo-fibular ligament, anterior talofibular ligament, posterior talofibular ligament as well as the joint capsule (Wu et al., 2002, Hertel, 2002). The function of the anterior talofibular ligament is to resist ankle plantarflexion and inversion that can result in an injury while calcaneo-fibular ligament prevents excessive inversion (Wu et al., 2002).

The subtalar (talocalcaneal) joint is the articulation between the talus and the calcaneus (Wu et al., 2002, Hertel, 2002). Interosseous and cervical ligaments provide

stability to the subtalar joint and form a wall between posterior and anterior joint capsules. Other crucial ligaments that contribute to the stability of this joint include the cruciate ligaments of subtalar joint and peripheral ligaments of subtalar joint namely fibulotalocalcaneal, lateral talocalcaneal and calcaneo-fibular ligaments. The function of the calcaneo-fibular ligament is to resist excessive internal rotation and inversion of the calcaneus relative to the talus (Hertel, 2002).

Distal tibiofibular (syndesmosis) joint is the distal articulation of tibia and fibula which allows for accessory gliding movement (Hertel, 2002). This joint is supported by the syndesmotic ligaments, namely anterior inferior tibiofibular ligament, transverse ligament, interosseous ligament and posterior inferior tibiofibular ligament (Wu et al., 2002). The function of the syndesmotic ligament is to prevent an abnormal increase in ankle mortise space by holding tibia tight to the fibula.

The stability of the ankle joint is made possible by the muscles which offer dynamic stabilization of the joints, static ligamentous restrains and the congruence of articular surfaces during loading of the ankle joint (Hertel, 2002). The key muscles that contribute to the stability of the ankle joint include peroneus longus, peroneus brevis, anterior tibialis, extensor digitorum longus, extensor digitorum brevis, and peroneus tertius (Moore et al., 2013, Hertel, 2002).

The foot supports the body during standing and plays an important role in locomotion (lever that propels body forward during running and walking) (Moore et al., 2013, Snell, 2011). The foot consist of 14 phalanges, 5 metatarsals and 7 tarsals (Moore et al., 2013). Each toe is made up of 3 phalanges, except the big toe which is made up of 2 (Snell, 2011). The foot and its bones may be classified into three parts namely (Moore et al., 2013): hind foot (talus and calcaneus), mid foot (navicular, cuboid and cuneiforms), forefoot (metatarsals and phalanges).

Arches of the foot act as shock absorbers during walking, running and jumping by distributing weight through the foot (Snell, 2011). The arch system comprises proximally of a single line of bones (calcaneus and talus) which distally splits into the lateral and medial arch kept together by oblique and transverse fiberss of plantar ligaments. These plantar ligaments also prevents the arches from collapsing when loaded with the body weight (Huson, 1991). Medial longitudinal arch consists of

calcaneus, talus, navicular, 3 cuneiform bones and first 3 metatarsal bones (Moore et al., 2013). Tibialis anterior muscle helps to strengthen this arch while fibularis longus tendon helps to support it (Snell, 2011). The lateral longitudinal arch consists of calcaneus, cuboid and 4th and 5th metatarsal bones(Snell, 2011, Moore et al., 2013). This arch is in contact with the ground when standing as it is lower and shorter (Huson, 1991). Lastly, the transverse arch consists of base of metatarsal bones, cuboid and 3 cuneiform bones. Tibialis posterior and fibularis longus tendons help in the maintenance of this arch (Snell, 2011, Moore et al., 2013). Flexor digitorum and interossei play an important role in maintaining the stability of the arches while intrinsic stabilise the metatarsophalangeal joints (Huson, 1991).

2.6 Mechanism of injury

Majority of ankle or foot injuries occur because of being tackled from the side with the direction of the force on the medial or lateral side and there is direct contact with the injured foot or ankle (Giza et al., 2003, Andersen et al., 2004). Player-to-player contact involving the injured player's medial part of the lower leg or ankle was reported as a common injury mechanism by Anderson et al. (2010). They also reported inversion injury to be common in tackling, running and landing injuries.

Inversion of ankle and foot (figure 2.2) also occur as a result of a twisting injury also known as "going over on the ankle" (van den Bekerom et al., 2013). The excessive supination may be caused by a greater ground reaction force moment arm at the subtalar joint which occurs during touch down when the foot is supinated, already resulting in susceptibility to sprains (Wright et al., 2000). Athletes with an increase in talar tilt are more susceptible to inversion injury than those with normal talar tilt (Firer, 1990).

Figure 2.2: Inversion injury

Source: http://physiodirectnz.com/ankle-sprain/

Anterior talo-fibular ligament is the weakest ligament in the lateral ankle and mostly gets injured during ligament sprain (Fong et al., 2009). Plantar flexion causes tightening of the anterior talo-fibular ligament which may rupture when there is an excessive and explosive internal rotation or plantar flexion (Fong et al., 2012). Ankle joint goes into plantarflexion before landing from a jump predisposing it to injury (Fong et al., 2012). The possible mechanism of injury for anterior talo-fibular ligament is inversion and plantarflexion.

One of the common foot injuries in football is Lisfranc injury. These injuries are usually of a low velocity with diastasis that is subtle or no displacement at all (Nunley and Vertullo, 2002). Lisfranc joint injury can be caused by foot planter-flexion and maximum dorsi-flexion of metatarsophalangeal joints with a direct downwards force onto the heel, resulting in hyper planter-flexion (Lattermann et al., 2007). The most common injury mechanism in athletes is when the foot sustains axial load while it is plantar flexed and slightly rotated (Nunley and Vertullo, 2002).

2.7 Diagnosis of ankle and foot injuries

The aim of initial evaluation of an athlete with ankle or foot injury is to identify the injured bony and soft tissue structures and establishing the mechanism of injury is vital as it can help the examiner with location and severity of the injury (Anderson et al., 2010). In order to properly diagnose an injury, the following history should be taken (Dubin et al., 2011): the date that the injury occurred, how the injury occurred, was there a popping sound when the injury occurred, is the patient able to put weight on the injured leg, is there history of previous injury as well as the treatment that was received and lastly sport-specific goals.

Physical examination should begin as soon as history taking is done and the examination should include observation for severe abnormalities, swelling, redness, neurovascular assessment and palpation for regions of tenderness (such as syndesmotic ligaments, deltoid ligaments and lateral collateral ligaments) (Dubin et al., 2011).

The important signs for ankle injury are swelling, bleeding in the area, pain that is localized on palpation and anterior drawer test that is positive (Wright et al., 2000, Espregueira-Mendes, 2017). Delayed assessment of about 4 to 5 days yields better results than an assessment within 48 hours; the sensitivity of delayed assessment is 96% and specificity is 84% (Espregueira-Mendes, 2017).

On palpation, around 60% of athletes presenting with acute lateral ankle ligament injury will have pain at the level of medial malleolus while 40% will have pain over anterior syndesmotic ligament (Wright et al., 2000).

2.8 Risk factors

There are various risk factors which predispose soccer players to ankle and foot injuries. Studies that have looked at foot and ankle injuries have highlighted age, foot type and size, previous ankle sprain, joint laxity, ankle instability, weight, height, muscle strength, limb dominance, type of field of play, use of orthosis or taping, type of shoes used by players, intensity of match and position of play to be key risk factors (Ekstrand et al., 2011, Halabchi et al., 2016, Henry et al., 2016).

2.8.1 Gender

The relationship between ankle injury and gender is unclear in the literature (Faude et al., 2006). However, risk factors predisposing women and men to ankle ligament injuries may be different (Beynnon et al., 2001). Some have reported joint laxity as a risk factor for ankle injuries in female soccer players (Faude et al., 2006). Increase in tibial varum rotation and increase in the compensatory range of motion of a calcaneal eversion has been reported to predispose women to ankle injuries while increased talar tilt predisposes men to injury (Beynnon et al., 2001). Therefore prevention intervention must take into consideration the gender of the soccer players when developed.

2.8.2 Age

Age is a significant risk factor for players who are older than 25 years (Östenberg and Roos, 2000). A prospective study by Östenberg and Roos (2000) looked at injury risk factors in female European football. The study found that players who were injured were older (mean 21.7) than those without injury (mean 20.1). Similar findings were reported by Stevenson et al. (2000) who looked at the epidemiology of sports injuries in Western Australia. This study reported a significant difference between mean age of those that had injuries and those with no injuries (24vs23), with older participants being injured. Therefore, the age of the players must be considered when developing a prevention programme for footballers.

2.8.3 Limb dominance

Soccer players tend to place more demands are placed on the dominant leg. which may result in high frequency and magnitude of moments on the ankle and knee (Beynnon et al., 2002). Östenberg and Roos (2000) looked at injury risk factors in female European football and reported that 44.6% of lower extremity injuries occurred on the dominant leg as compared to non-dominant leg (32.3%). Hawkins et al. (2001) also reported more injuries sustained by players on the dominant leg as compared to the non-dominant leg (50% and 37% respectively). These injuries are usually contact or overuse injuries (Faude et al., 2006).

2.8.4 Previous sprain

The presence of previous ankle sprain was reported as an ankle sprain risk factor. A study by Hawkins et al. (2001) looked at the epidemiology of injuries sustained in professional football and found that out of all injuries, 7% of them were re-injuries. Similarly, Kofotolis et al. (2007) reported 139 injuries and 60.5% of them were reported by athletes with a previous ankle sprain while the rest were occurring for the first time. The study also indicated that the previous injury is a significant predictor variable for ankle injury risk factors. Previous ankle injury results in fibrosis and adhesions which decrease ankle range of motion and limits function. Limited joint motion results in muscle wasting and more compensatory stress on other sites, therefore predisposing these areas to injury (Caine et al., 2008).

2.8.5 Foot posture

Various studies have been done to determine the relationship between foot posture and ankle and foot injury. Foot morphology plays an important role in the effect of a relation between ground reaction force and rotational axes of the ankle and other lower limb joints (Beynnon et al., 2002). Presence of a high arch in a football player increases the risk of overuse injury due to high relative and impulse loading as compared to those with normal arch (Carson et al., 2012).The weight bearing status of the ankle and foot at a time of injury has been reported as a significant risk factor for ankle and foot injury (Giza et al., 2003). Giza et al. (2003) reported that majority ankle and foot injuries (46%) occurred when the ankle and foot were pronated as compared to neutral position (38%). Potential ankle and foot injury risk may be minimised by classifying arch structure at pre-participation screening (Carson et al., 2012).

2.8.6 Ankle instability

Sporting activities with constant jumping, cutting movements and running may predispose athletes to risk for ankle sprain. Most ankle sprains do not resolve completely and result in dysfunction and residual symptoms which may lead to the development of chronic ankle instability (Halabchi et al., 2016). Chronic ankle instability is associated with impairments such as proprioception deficiencies and ligamentous laxity (Hiller et al., 2011). The instability may be classified into mechanical instability and functional instability (Attenborough et al., 2014). Functional instability, also referred to as perceived instability is subjective and a feeling of “giving way” of

ankle joint complex is mostly reported (Attenborough et al., 2014). The feeling of "giving way" of ankle joint experienced by subjects with functional instability may be as a result of abnormal increase in inverted position of ankle joint and decreased vertical floor clearance experienced during gait (Delahunt et al., 2006). Disruption of proprioceptive nerve fibres and impairment of neuromuscular control are functional insufficiencies that have been proposed to result in functional instability (Hiller et al., 2011). The systematic review by Munn et al. (2010) yielded conflicting results on sensorimotor factors associated with functional ankle instability which made it difficult to identify different sensorimotor impairments associated with functional ankle instability. Mechanical ankle instability is physiological laxity of ligaments that support the joint ankle joint (Munn et al., 2010, Hiller et al., 2011, Attenborough et al., 2014). In the acute phase of injury assessment for structural impairments is done to establish signs of mechanical instability (Attenborough et al., 2014). Though chronic ankle instability is prevalent, it is still poorly understood by clinicians and researchers (Hiller et al., 2011).

2.8.7 External support

Forces transmitting through the lower limb may be altered by applying an external support like taping (Surve et al., 1994). Ankle taping is postulated to enhance proprioception in the injured ankle joint (Osborne and Rizzo Jr, 2003). Ankle brace functions by restricting motion before ankle /foot is loaded by body weight during free fall phase (Eils and Rosenbaum, 2003). Surve et al. (1994) reported that use of sport-stirrup orthosis significantly lowered the occurrence of severe ankle injuries in ankles that were previously sprained. The principal finding of their study was that the use of semi rigid ankle orthosis significantly lowered the occurrence of ankle sprains in ankles that were previously injured as compared to those that were not previously injured. All the braces that Eils and Rosenbaum (2003) tested restricted inversion angle effectively and also significantly lowered inversion velocity, therefore, ankle braces are a means of effectively lowering incidence of recurrent ankle sprains (Osborne and Rizzo Jr, 2003).

2.8.8 Position of play

Player's position can increase the risk of incurring ankle injuries. Azubuike and Okojie (2009) found that defenders had more injuries than other playing positions (role) and results were consistent within the national league. While defenders were reporting more injuries in the premiere ship league (47.6%), the national amateur league (30.9%) and professional league (47.1%), in the state league strikers (34.7%) were reporting more injuries than defenders (30.4%). They also reported that defenders recorded high injury incidence (34.3% role specific injury of 1.3) whereas goalkeepers had less injury incidence (9.8%, but high role specific injury of 1.4). This study was in agreement with a study by Kofotolis et al. (2007) who reported that goalkeepers had a lower injury rate. As compared to midfielders (32.3%) and forwards (20.8%), defenders had a significantly higher injury rate (42.4%). Their further analysis showed that defenders incurred more number of contact injuries (43.1%) than non-contact (41.4%) injuries. This may be because the risk of injury is high in areas of attacking and defending as ball possession in these areas is mostly contested for resulting in increased number of contact injuries (Faude et al., 2006).

2.8.9 Type of playing ground

The condition of a playing ground (presence of hardness or uneven ground) may present as a hazard and thus a subsequent risk for ankle and foot injury. Chomiak et al. (2000) looked at influencing factors of severe injuries in football and reported that 21% of players with injury credited the cause of their injury to bad quality of playing ground; the playing ground was reported as either being uneven or slippery. Poor pitch quality was also reported by Azubuike and Okojie (2009). The study reported that 81.4% of injuries occurred on a ground that was either hard or dry. Better management of the playing field is important in reducing the prevalence of ankle and foot injuries.

2.8.10 Match exposure

Match exposure has been has been highlighted as one of the risk factors for ankle and foot injuries. Arnason et al. (2004) looked at the risk factors in football and reported that that players who had higher match exposure (mean 16.3 matches) were more injured as compared to those with lower match exposure (mean 12.4 matches). A contradictory report was made by Faude et al. (2006) who reported that players with a higher match exposure had a significantly reduced injury risk as compared to the

reference group. The contradicting reports indicate the need for more research to be conducted in order to reach a consensus.

2.8.11 Playing time (experience)

Experience (playing years) has been reported in the literature as a risk factor. Östenberg and Roos (2000) looked at the injury risk factors in female European football and reported that the injured players had more experience (mean 13.8) than those without injury (11.5) (p-value=0.02). A regression analysis by Kofotolis et al. (2007) who looked at ankle sprain injuries and risk factors in amateur soccer players did not show a significant prediction of injury by playing years ($p>0.05$). There is a need for stringent application of prevention strategies across all age groups to reduce injury risk.

2.8.12 Proprioception

Proprioception is an important part of balance control and ankle proprioception is an integral part of this (Han et al., 2015). The processing of proprioceptive information together with sensory information allows for balance and postural control (Han et al., 2015). Disturbances in sensory motor may occur as a result of disturbances in proprioception and this may lead to long term effects on musculoskeletal disorders (Röijezon et al., 2015). The disturbance of proprioception in musculoskeletal disorders can be due to fatigue, pain, trauma and presence of effusion affecting both the central and peripheral pathophysiology of the nervous system (Röijezon et al., 2015). McKeon and Hertel (2008) did a systematic review of postural control and lateral ankle instability and reported substantial reduction in the risk of ankle sprains post prophylactic balance and coordination training in athletes and this was seen more on those with previous sprain.

2.9 Impact of ankle and foot injury on activities of daily living and participation in leisure and sports activities

Injury to ankle joint can result in acute as well as chronic ankle disability and the disability can either be functional instability or late degenerative changes (Ekstrand and Tropp, 1990). The feeling of “giving way” of ankle joint experienced by subjects with functional instability may be as a result of abnormal increase in inverted position of ankle joint and decreased vertical floor clearance experienced during gait (Delahunt et al., 2006). Functional instability is closely associated with stiffness, pain and

swelling and usually the two outcomes happen together (Kannus and Renstrom, 1991). Konradsen et al. (2002) looked at the frequency of residual seven years post injury to ankle or subtalar structures and reported 32% complaints of chronic pain, swelling, and recurrent sprains. Of the 32% with chronic complaints, 4% of the subjects considered themselves severely disabled while 23% considered themselves functionally impaired by the residual symptoms. The analysis of the study further showed that 16% of subjects had pain and 22% had swelling which was either constant, moderate or severe. A similar study was conducted by Hiller et al. (2012) looked at the prevalence and impact of chronic musculoskeletal ankle disorders and reported 23.7% chronic ankle disorders. The study also reported pain as the most common complaint (73.5%) followed by weakness (72.1%) and instability (60.5%). In this study, 80% of subjects with chronic ankle complaints reported that the disorder limited or modified their activity.

Residual symptoms such as instability, crepitus, weakness and stiffness often affect athletic performance (Yeung et al., 1994). Anandacoomarasamy and Barnsley (2005) looked at the long-term outcomes of inversion ankle injuries sustained during sports and reported a high rate (74%) of presence of at least one residual symptom when athletes were assessed 1.5-4 years after injury. They also reported that though the athletes had persisting symptoms, majority of them (16 out of 19) returned to sport. Three were persistently impaired by the ankle injury which resulted in two of them changing to other sports and one leaving sports completely.

Residual symptoms negatively impact on activities of daily living and participation in leisure and sports activities. It is therefore important for injuries to be managed well to reduce these chronic musculoskeletal disorders.

2.10 Management of ankle and foot injuries

Poor management of ankle injury may lead may lead to a number of problems such as functional instability and osteoarthritis (Fong et al., 2009).

2.10.1 Treatment

After sustaining ankle or foot injury, elastic bandage coupled with intermittent pneumatic compression can be effective in relieving pain, improving joint motion and reducing swelling (Airaksinen et al., 1990). By doing this, rehabilitation may yield good

results and limb function may be improved. For initial pain management stage, RICE (rest, ice, compression and elevation) can be generally effective (Denegar and Miller III, 2002). Immobilisation for a short period is more favoured than immobilisation for more than 2 weeks (Nery et al., 2016).

Electrical current reduces inflammation by keeping fluids and plasma proteins from leaving capillaries and entering extracellular tissues (Feger et al., 2015). This results in oedema reduction and ultimately decrease in pain and increase in function (Feger et al., 2015).

Treatment goal post acute ankle injury is to lower the risk of chronic ankle instability and sustaining another ankle injury (Nery et al., 2016). Majority of ankle sprains (80%) can reach full recovery by being managed conservatively and only 20% develop functional or mechanical instability which results in chronic ankle instability (Nery et al., 2016). Athletes who suffer from ankle instability often miss training and matches, require continuous care and usually perform sub optimally (Denegar and Miller III, 2002).

Early range of motion exercises and neuromuscular training aid in quickest recovery and early return to physical activity and work (Kannus and Renstrom, 1991). The healing tissue should be kept in a shortened position during exercise and the range of motion could be performed from beginning to mid-range (Denegar and Miller III, 2002).

When managing ankle and foot injuries, healing and long term functional outcomes should not be compromised (Anderson et al., 2010). Treatment should include aggressive rehabilitation (Anderson et al., 2010) with good knowledge of inflammation and lower extremity biomechanics (Denegar and Miller III, 2002). Included as well inthe treatment is management of inflammatory symptoms, restoration of normal joint and accessory joint motions and gradual application of stress to healing tissues (Denegar and Miller III, 2002).

To restore stability of ligaments, it is important to know the time frame for acute inflammation and repair so that collagen deposit can be given enough time before stress is applied (Denegar and Miller III, 2002). The requirement is that tissue stress should be increased gradually instead of sudden increase in load once there has been corrections on joint mobility restrictions (Denegar and Miller III, 2002)). The technique should be to unload instead of stressing the injured tissue (Denegar and Miller III,

2002) as stressing the tissue may result in secondary inflammatory response (Mattacola and Dwyer, 2002). Treatment goals and the decision whether to operate or not are done to ensure safe return to sport and to decrease the risk of more or recurrent injury (Anderson et al., 2010). The overall goal should be early return to sport (Denegar and Miller III, 2002, Anderson et al., 2010).

2.10.2 Rehabilitation

Rehabilitation can start only if pain and swelling are manageable (Osborne and Rizzo Jr, 2003). Once pain and swelling are controllable and range of motion attained then the athlete can progress to the phase of strengthening rehabilitation (Mattacola and Dwyer, 2002).

Number of recurrent sprain can be reduced by rehabilitation programs like proprioception training (Osborne and Rizzo Jr, 2003). McKeon and Hertel (2008) reported that the risk of having recurrent ankle sprain was reduced for up to 1 year after completion of 6 weeks training on balance and coordination. Injury can interrupt proper functioning of neuromuscular feedback mechanism, therefore, it is important to include proprioception in rehabilitation so that dynamic joint and functional stability can be archived (Lephart et al., 1997). Proprioception training should be incorporated into functional exercises and the activities should be specific to the individual or body part (Röijezon et al., 2015). Balance training exercises should be included once weight bearing and pain free range of motion have been achieved (Kannus and Renstrom, 1991). The training should not provoke effusion, fatigue or pain as they may negatively affect motor learning as well as proprioception (Röijezon et al., 2015). The goal for most athletes is to develop better balance control and proprioception by training and activities like the use of wobble board can help in archiving this (Han et al., 2015).

In the first 3 to 4 weeks exercise should be of low resistance and high repetitions and as remodelling of tissue progresses, repetitions can be minimised while resistance is increased (Denegar and Miller III, 2002). These activities may be done during the rehabilitation phase (Dubin et al., 2011):

- Joint mobilisation to improve range of motion
- Passive stretch of gastrocnemius and soleus muscles
- Isometric exercise to prevent muscle atrophy

- Strengthening exercises for tibialis anterior, extensors and triceps surae using a thera-band
- Proprioception training using wobble board, air-filled cushion and biomechanical ankle platform system
- Modify shoe gear according to foot posture and surface of play
- Progress appropriately modified activity
- Ice therapy and other modalities should be applied after each treatment session to regulate inflammation

For advanced phase rehabilitation, activities should mainly be for regaining normal function and such activities should be sport specific exercises (Mattacola and Dwyer, 2002). Restoration of neuromuscular control and maximising dynamic, reflexive stability of ankle joint complex should be done once restoration of joint mobility has been archived and healing tissues well protected (Denegar and Miller III, 2002). The severity of the injury and the ability of the athlete to perform sport specific activities determines the time a player can return to practice or competition and return to play decision must be taken as per individual as it varies from player to player (Nery et al., 2016).

Inadequate rehabilitation has been established as an important risk factor for recurrent injuries and the high number of re-injuries in football suggests rehabilitation inadequacy and incomplete healing (Dvorak and Junge, 2000). The risk of injury is lowered when rehabilitation is effective and athlete has attained range of motion, strength and proprioception same as preinjury state (Mattacola and Dwyer, 2002). The goal is for the athlete to return to the level of competition similar or higher than before acquiring the injury as quickly as possible (Mattacola and Dwyer, 2002).

2.10.3 Prevention

To establish an effective injury prevention program, it is important to have a detailed injury mechanism background (Oztekin et al., 2009). Players and their environment should be considered when coming up with and implementing injury prevention strategies as well as other factors such as equipment that they use and quality or condition of the pitch (Junge et al., 2002).

Prevention strategy for soccer injuries according to Nery et al. (2016) include:

- Warm up with more focus on stretching
- Cool down regularly
- Adequate rehabilitation with sufficient time for recovery
- Proprioception training
- Protective equipment
- Good condition of playing field
- Following rules of play

Dysfunction in the muscular, neural and mechanical mechanisms are said to cause chronic ankle instability (Mattacola and Dwyer, 2002). Development of strength and neuromuscular control in the ankle and foot is important for protection and better control during stance and impact (Mattacola and Dwyer, 2002).

There is need for educating players and coaches on strategies that can prevent injuries and such strategies should be included in the everyday training program (Junge et al., 2002). It is also important, as injury prevention, to observe laws of the game and most importantly the spirit of fair play (Chomiak et al., 2000). Chomiak et al. (2000) reported foul play as a cause of all contact injuries.

2.11 Outcome measures used

Foot and ankle outcome score (FAOS) and foot posture index (FPI) are some of the health outcome measure tools that are used in sports.

2.11.1 The foot posture index (FPI)

FPI is a foot specific outcome measure that was developed to easily quantify differences in foot posture (supination, pronation and neutral) (Keenan et al., 2007). The tool classifies foot posture into six items (Redmond, 2005): (i) palpation of the head of the talus; (ii) curvatures above and below the lateral malleolus; (iii) position of the calcaneus in the frontal plane; (iv) prominence in the talo-navicular joint; (v) the medial longitudinal arch's congruence; and (vi) abduction/ adduction of the forefoot on the rear-foot. The score for each item is -2 to 2 with a total score of -12 to 12 indicating supinated foot posture (negative value) and pronated foot posture (positive value) (Aquino et al., 2018). The scale for foot posture index is set in such a way that zero is the central response and any deviation from this central response indicates the

direction of the postural change (Redmond et al., 2006).The foot posture index was particularly developed to be used in large sample studies where it is not necessary to carry out complex and extensive foot assessment (Keenan et al., 2007).

FPI has been proved to be a reliable tool. The study by Aquino et al. (2018) looked at the inter-rater and test-retest reliability of FPI-6 by assessing foot posture of 21 adults and older adults. The results showed a score of ICC 0.69 test-retest reliability and ICC 0.79 inter-rater reliability score for adults whereas for older adults test-retest reliability was ICC 0.44 and inter-rater reliability ICC of 0.69. Similarly Another study by (Evans et al., 2003) looked at the interrater and intra-rater reliability of the FPI comparing it with some of the traditional measures of foot position used by podiatric physicians namely navicular height, navicular drop, resting calcaneal stance position, neutral calcaneal stance position and forefoot-to-rearfoot measurements. The study was conducted on three categories of people: adults aged 20 to 50 years, adolescents aged 8 to 15 years, and children aged 4 to 6 years. The FPI had showed a better reliability (ICC 0.58-0.74) than other measures across all the age groups studied. The satisfying interrater and intra-rater reliability score may suggest that the foot posture index may be valuable in the assessment of foot in a clinical setting.

2.11.2 Foot and ankle outcome score (FAOS)

Foot and ankle outcome score (FAOS) is one of the health outcome measure tool that measures functional level of a patient including aspects of health such as pain, overall function and quality of life. It is a self-administered questionnaire that comprises of 42 items covering 5 subscales: pain, other symptoms, activities of daily living (ADLs), sports and recreational activities, and foot and ankle related quality of life (QoL). All items are scored from zero to four, and each of the subscale scores is calculated as the sum of the items included. Raw scores are transformed to a zero to hundred, worst to best scale.

The FAOS tool has been proven to be a valid, reliable and responsive instrument. A study with an aim to validate the FAOS for use in forefoot pathology patients, specifically hallux valgus was conducted by Chen et al. (2012). The results of the

study showed that the FAOS is a valid and reliable tool to measure the outcome of hallux valgus patients with a test-retest score of ICC ranging from 0.76 to 0.93 for all the five subscales. A similar study was done by Mani et al. (2013) who validated the FAOS for use in patients with hind foot deformity, specifically adult acquired flat foot deformity. The study showed a test-retest reliability sore of ICC ranging from 0.79 to 0.88 for all subscales. The quality of life subscale was found to be highly responsive to post-surgical outcomes ($p<0.001$). The FAOS tool has been shown to be a useful tool in the assessment of functional level in patients with different foot pathologies.

The reliability and the validity that has been shown by both the FPI and FAOS tools may suggest their high value in foot assessment in a clinical setting.

2.12 Conclusion

In the initial phase of acute ankle injury, treatment of choice should be functional ankle rehabilitation and surgery may be done for clients who a comprehensive non operative treatment program did not succeed (Osborne and Rizzo Jr, 2003). Poor management of ankle injury may lead may lead to a number of problems such as functional instability and osteoarthritis (Fong et al., 2009).Patients with functional instability have been found to have a joint dysfunction which can either be as a result of hypermobility or hypo mobility (Denegar and Miller III, 2002). The injured athlete requires rehabilitation that is sport specific and bones, tendons and ligaments that are recovering should be challenged without causing harm (Mattacola and Dwyer, 2002). Functional rehabilitation should be supported by neuromuscular training post ankle injury (Petersen et al., 2013). To establish an effective injury prevention program it is important to have a detailed injury mechanism background (Oztekin et al., 2009). Balance training plays an important role in preventing re-injuries and also, braces have an effect in preventing ankle injuries in athletes(Petersen et al., 2013).

3 CHAPTER THREE: METHODOLOGY

3.1 Introduction

In this chapter the methodology of this study will be discussed in detail. This includes study design, ethical considerations, data collection procedure, and analysis. The validity and reliability of the data collection tools used in this study will also be discussed based on the literature.

3.2 Study design

A cross-sectional design (Fitzgerald and Moss, 2012) approach was adopted for this study as it enabled the researcher to examine the relationship between independent variables (playing position, foot type, playing ground, age,) and the dependent variable (ankle and foot pain). The study was conducted over 8 weeks towards the end of the football league season.

3.3 Study population

The study population included six premiere league teams in Gaborone. Each team comprised of twenty-five (25) registered semi-professional soccer players. Therefore, 150 premiere league players in Gaborone were targeted. Of these hundred and fifty players, ten players participated in pilot study leaving 140 participants for the main study.

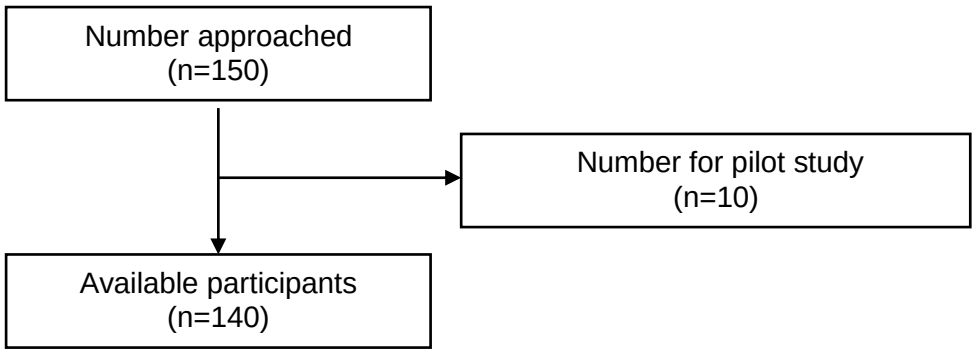

Figure 3.1 Flowchart of study population

The Botswana premiere league

The Botswana premiere league is the highest-level football league in Botswana. It consists of 16 football teams in total. The various teams are distributed nation-wide and out of the 16, six teams are in Gaborone. The league recently upgraded from being amateur to a semi-professional league. The premiere league season runs from August to May. The first half of the season is from August to December and the second half runs from January to May. Matches are played in a round robin format in each half a season, totalling 30 games for each team by the end of the season.

3.4 Eligibility criteria

3.4.1 Inclusion criteria

a. Players who were registered with the team for the 2017/2018 season

b. Players who were 18 years and above

3.4.2 Exclusion criteria

a. Players with injuries that were not related to football.

3.5 Sampling

The researcher visited all the premiere league teams in Gaborone and the objectives and aim of the study were explained. A list of players was obtained from each team management and from premiere league office in order to establish who was registered with the team. All the soccer players who were interested in the study signed the consent form.

Table 3.1*Sample of the available participants for 2017/18 season*

Team	**Available subjects**
BDF IX	25
Township Rollers	25
Gaborone United	25

Security Systems	25
Shaps Shooting Stars	25
Gilport	25
Total	**150**

3.6 Outcome measures and instruments

Foot and Ankle Outcome Score (FAOS) (Appendix E) was used to establish the prevalence of ankle injuries (Mani et al., 2013). It is a self-administered questionnaire that comprises of 42 items covering 5 subdivisions. Five Likert-boxes (no, mild, moderate, severe, extreme) are used to answer each subdivision. All items are scored from zero to four, and each of the subscale scores is calculated as the sum of the items included. Raw scores are transformed to a zero to hundred, worst to best scale. The Internal consistency of the tool ranges from 0.88 to 0.97 for the subscales and the intra-class correlation coefficients (ICC) ranged from 0.70 to 0.92 for the subscales (Roos et al., 2001).

Previous injuries were assessed using a self-administered questionnaire (appendix F) which was part A of the foot and ankle outcome score. The questionnaire was also used to determine whether the soccer players use ankle protection (taping or ankle braces).

Foot Posture Index (FPI) (Appendix C) was used to measure the foot type intrinsic factor. It has 6 items which are aimed to quantify the degree to which the foot can be considered pronated, supinated or neural position. Initially eight measures were incorporated and this was later refined to six items after a series of validation studies. When the scores are combined, the aggregate value gives an estimate of the overall foot posture. High positive aggregate value indicate a pronated posture, significantly negative aggregate value indicate a supinated overall posture, while for a neutral foot the final aggregate score should lie somewhere around zero. It has Intra-class correlation coefficients ranging from 0.62 to 0.91. The inter-tester reliability of the original eight items ranged from 0.62-0.91 and intra-tester reliability ranges from 0.81-0.91 (Redmond et al., 2006, Evans et al., 2003).

3.7 Data collection procedure

After ethical clearance and permission from the league was granted, the researcher visited the teams during their training hours. A short presentation on what the research is all about and entails was done for each team. Each participant was then given an information sheet and was requested to sign a consent form thereafter.

3.7.1 Pilot study

The pilot study was conducted using 10 participants from the target population size. The objectives of the pilot study were to:

- Assess the feasibility of the study
- To familiarise the researcher with the outcome measures
- To assess how long it will take to administer questionnaires
- To assess how long it will take to do the foot posture index test

3.7.2 Pilot study procedure

1. The researcher visited the team in the afternoon when they went for training. Data was collected before the start of training.
2. Soccer players that did not meet the inclusion criteria where each addressed separately. The inclusion criteria was explained to them and the reason for excluding them was also explained.
3. Soccer players who met the inclusion criteria were briefed on the purpose of the study and for each participant a written consent was obtained for participation. Demographic data was captured and the researcher gave out one self-administered questionnaire (foot and ankle outcome score) that explored the nature of ankle injuries and the prevalence of ankle injuries. The foot and ankle outcome score questionnaire took approximately ten minutes to complete per participant. The researcher carried out a foot posture index assessment on each participant. Out of the 10 participants, only three (30%) reported to have had ankle and foot pain. They all reported mild symptoms of pain and that the injury was not interfering with their sports nor their activities of daily living.

3.7.3 Main study

1. The recommendations from the pilot study were incorporated in the main study.
2. The same process as outlined in the pilot study was followed

3.8 Data analysis

The gathered information was captured and coded using Microsoft Excel. The data was then transferred to Stata version 15.1 for analysis. Data was analysed using descriptive statistics to establish ankle and foot injury prevalence and selected ankle and foot injury associated risk factors. Fisher's exact test and Chi-square test were used to measure associations between groups. The association between categorical variables and the outcome was measured using Fisher's exact test. Descriptive data was presented as frequencies and percentages. Significance was set at P value less than 0.05. Table 3.2 below shows a summary of statistical tests used.

Table 3.2 Data analysis matrix

Objectives	Variables	Type of data	Statistical tests
To establish the prevalence of ankle and foot injuries in the first half of the current season among premiere league players in Gaborone	Previous history of ankle injury Current ankle injury	Binary Binary	Frequency Percentages Frequency Percentages
To establish the extent of ankle and foot pain and symptoms of pain experienced by players	Stiffness Pain	categorical	Frequency Percentages
To determine associated risk factors of ankle and foot injuries	Previous injury Age Foot type Limb dominance Playing position Ankle protection Playing field	Binary Continuous Categorical Categorical Categorical Categorical Categorical	Fisher's exact test

To determine the association between ankle and foot injuries and difficulty with activities of daily living.	Activity	Categorical	Fisher's exact test
To determine the association between ankle and foot injuries and difficulty with sports and recreation	Function Sports	categorical	Fisher's exact test

3.9 Ethical considerations

Ethical clearance certificate was approved from Human Research Ethics Committee of University of Witwatersrand before conducting the study (clearance certificate M170854). Permission to conduct the study was granted by the Gaborone premiere league office (Appendix A) and each team management (Appendix B). Participants were informed about the assessment through the information sheet (Appendix C) and written consent (Appendix D) was obtained before data collection was done. No identifiable information that might trace back to the participants was asked. The responses were anonymous and were only used for this study. Confidentiality was maintained. Privacy was maintained by doing assessment in a secluded room.

3.10 Summary

This was a cross-sectional study design, where self-administered questionnaire and the foot posture index assessment form were used for data collection. A convenience sampling technique was employed in this study. The captured data was managed in Microsoft excel and then transferred to Stata where analysis was done.

4 CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the results of the pilot and the main study.The results are presented using both tables and graphs. The chapter comprises of five sections;

Section A: Pilot study

Section B: Response rate and Demographis data

Section C: Prevelance rate of ankle and foot injuries

Section D: Associated risk factors

Section E: Foot and ankle outcome score

4.2 Section A: Pilot study

The objective of the pilot study was to assess the feasibility of the study and for the researcher to familiarise herself with the outcome measures. Data was collected using the foot ankle outcome score and the foot posture index.

4.2.1 Results for the pilot study

Table 4.1 Demographic characteristics of the participants (n=10)

Variable	
Age, Median (IQR) in years	22 (20-26),
Playing time, Median (IQR) in years	6 (5-11)
Match history, Median (IQR)	10 (7-28)
Playing position, n (%)	
Goal keeper	2 (20)
Defender	3 (30)
Midfield	4 (40)
Striker	1 (10)
Limb dominance, n (%)	
Right leg	6 (60)
Left leg	3 (30)
Both	1 (10)

Table 4.1 shows that there were 10 soccer players who participated in the pilot study. The median age of the soccer players was 22 (20-26) years. Majority of soccer players were midfielders (40%), followed by defenders (30%) then goal keepers (20%) and strikers (10%).

4.2.2 Prevalence of ankle and foot injury

The prevalence of ankle and foot injuries over the last six months is outlined in figure 4.1.

Out of the 10 soccer players, three (30%) reported having had ankle and foot pain.

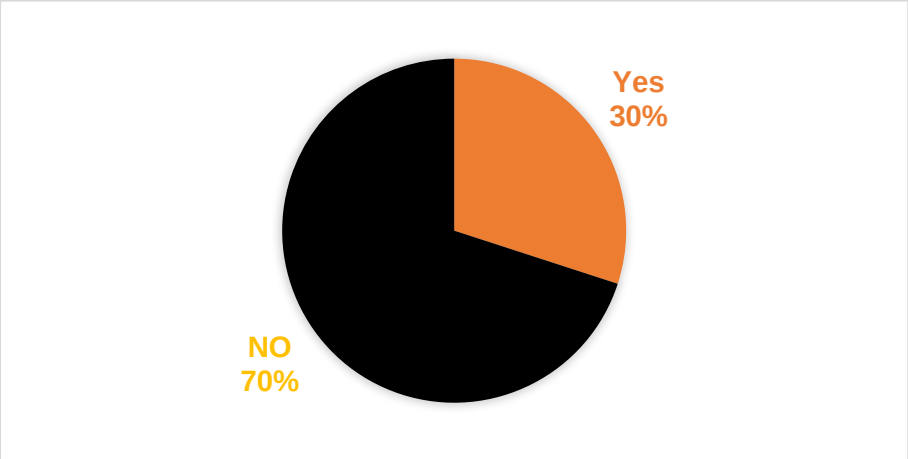

Figure 4.1 Prevalence of ankle and foot injury (n=10)

Of the three soccer players with foot and ankle injury, one played in the midfield while the other two soccer players were defenders. Two got injured while playing on a dirt ground during training and one got injured during a match on a grass field. They all reported mild symptoms of pain and that the injury was not interfering with their sports nor their activities of daily living.

The researcher did not encounter any problems with the pilot study.

The main study was conducted using the methodology as outlined in the pilot study. All the participants included in the pilot study were excluded from the main study.

The overall time taken by the soccer players to complete the foot and ankle outcome score questionnaire was approximately 10 minutes. The researcher carried out a foot

posture index assessment on each soccer player and each assessment took approximately eight minutes to complete.

4.3 Section B: Main study

4.3.1 Response rate

Presentation of the study objectives was done for all teams, a total of 150 soccer players was targeted. Seven soccer players were excluded from the study as they were under the age of 18 years, 24 players declined to participate in the study and the 10 soccer players that participated in the pilot study were excluded from the main study leaving 109 soccer players for the main study. Therefore, the response rate was 82% of the total eligible players.

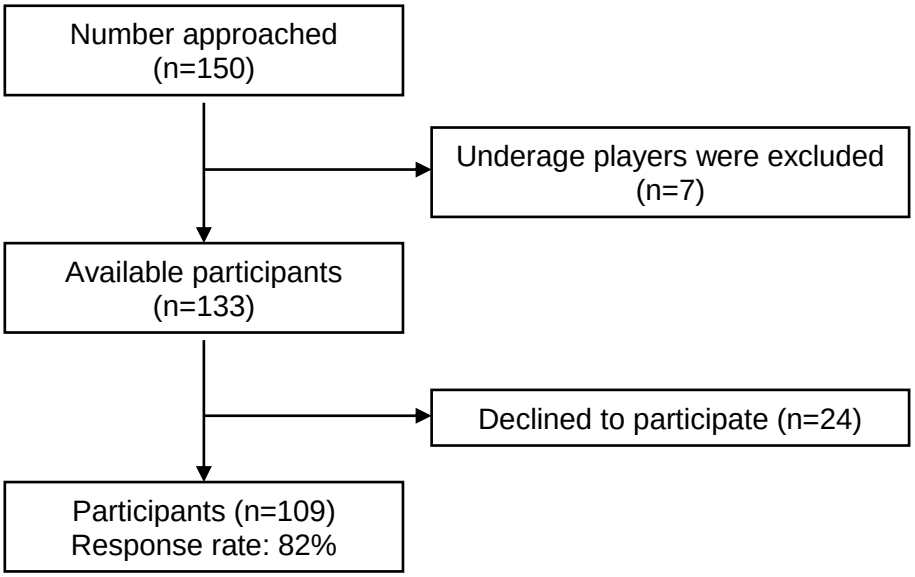

Figure 4.2 Flowchart of recruitment process

4.3.2 Test for Normality

Test for normality of all the continuous variables was conducted using the Shapiro-Wilk test. The result of the test for normality is presented in Table 4.2.

Table 4.2 Shapiro-Wilk Test for normality (n=109)

	Shapiro-Wilk		
	Statistic	**df**	**Sig.**
Age	0.97	108	0.02
Time playing	0.94	108	0.00
Match history	0.93	108	0.00
Symptoms	0.93	51	0.01
Pain	0.95	51	0.02
Activities of daily living	0.51	51	0.00
Recreation and sports	0.97	51	0.28
Quality of life	0.93	51	0.01

As shown in Table 4.2, the recreation and sports section of the foot and ankle outcome questionnaire is the only variable that was normally distributed, p-value =0.28. Therefore, non-parametric statistics (median and interquartile range) was used to summarise the skewed variables and parametric statistical tools (mean and standard deviation) was used for the normally distributed variable (recreation and sports).

4.4 Demographic characteristics of the participants

Table 4.3 illustrates the demographic characteristics of the participants according to age, playing time, match history, playing position and limb dominance.

Table 4.3: **Demographic characteristics of the participants (n=109)**

Variable	**Descriptive**
Age- Median (IQR) in years	24 (22-26)
Playing time- Median (IQR) in years	7 (5-9)
Match history- Median (IQR)	12.5 (8-21.5)
****Playing position, n (%)**	
Goal keeper	14 (12.8)
Defender	31 (28.4)
Midfield	49 (45)
Striker	15 (13.8)
Limb dominance, n (%)	
Right	58 (53.7)
Left	31 (28.7)
Both	19 (17.6)

** one field was missing (N=108)

There were 109 players who participated in this study. The median age of the participants was 24 (22-26) years. Majority of participants were midfielders (45%), followed by defenders (28.4%) then strikers (13.8%) and goal keepers (12.8%).

4.5 Section C: Prevalence of ankle and foot injuries

The prevalence of ankle and foot injuries over the last six months is outlined in figure 4.3.

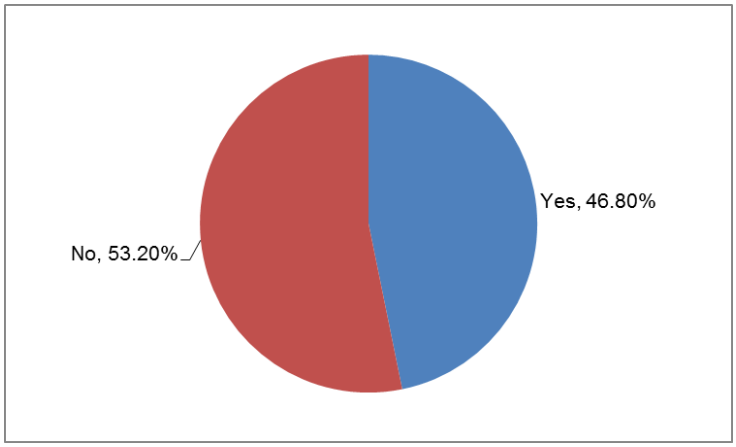

Figure 4.3 Prevalence of ankle and foot injury (n=109)

4.6 Section D: Risk factors associated with ankle and foot injuries

4.6.1 Intrinsic risk factors

The intrinsic risk factors assessed in this study were: previous injury, age, limb dominance and foot posture. The significant difference in age between participants with injury and those without injury was analysed using the Mann-Whitney U test. The results are presented in this section.

4.6.1.1 Previous history of ankle and foot injury

The presence of previous history of ankle and foot injury is outlined in Table 4.4.

Table 4.4 History of an ankle and foot injury in the left and right leg

	Left leg, n=40		Right leg, n=49	
Number of the previous injuries	n	%	n	%
1	23	57.5	25	51.02
2	8	20.0	19	38.78
3	7	17.5	3	6.12
4	1	2.5	1	2.04
5	1	2.5	1	2.04

Of the 109 participants, 54.6% (n=59) of the participants reported the presence of the previous history of ankle and foot injury. Majority of the participants reported one previous ankle and foot injury (right 51.02%), left 57.5%).

Table 4.5 outlines the time the player took away from training or match because of the previous injury.

Table 4.5 Cross tabulation of the days that players missed training and match due to injury on the left and right leg

	Left leg (n=42)		Right leg(n=50)	
For how long were you unable to fully play/train	n	%	n	%
1-3 days	24	57.1	29	58
4-7 days	9	21.4	15	30
1-4 weeks	5	11.9	5	10
More than 4 weeks	4	9.5	1	2

Fifty eight percent of players injured on the right were unable to play or train for 1-3 days whereas 57.1% of players injured on the left were unable to play or train for the same amount of time. The least number of time players took away from play or training was more than 4 weeks (left=9.5%, right=2%).

Table 4.6 Association between the history of injury and current injury

	Current ankle and foot injury			
	Yes		No	
Previous ankle and foot injury	n	%	n	%
Yes	34	66.7	25	43.9
No	17	33.3	32	56.1

As shown in table 4.6, 66.7% (n=34) of the participants with current ankle and foot injury reported a history of previous ankle injury while 43.9% of the participants with current ankle injury did not report any history of previous injury.

Table 4.7 Fischer's exact test for previous history of an ankle and foot injury

	Current history of ankle and foot injury (Fischer's exact test)
Previous history of ankle and foot injury	0.02*

Table 4.7 shows a significant association between previous history of an ankle and foot injury and current ankle and foot injury (p=0.02).

Table 4.8 Univariate binary logistic regression for a history of the previous injury as a predictor of an ankle and foot injury

	Exp (B)	p-value	95%CI
Previous history of ankle and foot injury	0.39	0.02	0.18-0.85

Univariate binary logistic regression was used to determine the predictor of current ankle and foot injury using previous ankle and foot injury as an explanatory variable was conducted. The results of the logistic regression showed that the previous ankle and foot injury significantly increases the odds of presenting with a current ankle and foot injury by 0.39 (Table 4.8).

4.6.1.2 Age

The age of the participants and the differences between those with and those without injury is illustrated in table 4.9.

Table 4.9 Average difference in age between soccer players with injury and without injury

	Player age in years					
	Median	IQR	95%CI		Mann-Whitney U	p-value
With Injury	23	22-26	22.86	24.49	1284	0.23
Without injury	24	22-25.25	23.47	25		

As shown in Table 4.9 the median age of the soccer players with injury (23 years) is lower than those without injury (24 years) but the difference between those with and those without injury is not statistically significant, p= 0.23.

Table 4.10 Univariate regression measuring age as a predictor for ankle injury

		p-value	95% CI for EXP(B)	
	Exp(B)		Lower	Upper
Age	1.07	0.317	0.94	1.22

Table 4.10 indicates that age is not a predictor for an ankle and foot injury, p-value 0.317.

4.6.1.3 Limb dominance

The relationship between limb dominance and injury is illustrated in table 4.11.

Table 4.11 Association between presence/absence of injury and limb dominance

Limb dominance	Players with injuries, n (%)	Players without injuries, n (%)	Fischer's exact test (p-value)
Right	29 (56.9)	29 (50)	0.81
Left	13 (25.5)	18 (31.6)	
Both	9 (17.6)	10 (17.5)	

Players with right limb dominance had more injuries (56.9%) than those with left limb dominance (25.5%). However, there was no significant association (p=0.81) between injury prevalence and limb dominance.

Table 4.12 Univariate regression for limb dominance as a predictor of ankle and foot injury

Limb dominance	Sig.	Exp(B)	95% C.I	
			Lower	Upper
Right limb dominance	0.77			
Left limb dominance	0.47	0.30	0.084	1.74
Both	0.84	0.32	0.942	2.54

As shown in table 4.12 limb dominance is not a predictor of ankle and foot injury.

4.6.1.4 Foot posture

The relationship between foot posture and an ankle and foot injury is illustrated in table 4.13.

Table 4.13 Association between foot posture and presence of injury

Presence of injury	Neutral foot position	Pronation foot position	Supination foot position	Fisher's exact
Right limb dominance				0.125
No	2	37	4	
Yes	1	41	9	
Left limb dominance				0.06
No	4	37	17	
Yes	1	43	7	

Majority of the players who reported injuries were found to have foot pronation and those with supinated and neutral foot posture were least injured. Fisher's exact measure of association between ankle and foot injury prevalence and foot pronation showed that there is no significant association between the prevalence of ankle and foot injury and foot posture (p= 0.125 and 0.06).

Table 4.14 Univariate regression for foot posture

	Sig.	Exp(B)	95% CI	
Right limb dominance			Lower	Upper
Neutral foot position	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Pronation foot position	0.523	2.216	0.193	25.459
Supination foot position	0.967	0.947	0.076	11.87
Left limb dominance				
Neutral foot position	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Pronation foot position	0.178	4.649	0.497	43.446
Supination foot position	0.679	1.647	0.155	17.47

Results in table 4.14 show that foot posture is not a predictor of ankle and foot injury.

Table 4.15 illustrates multivariate binary logistic regression for intrinsic risk factors.

Table 4.15 Multivariate binary logistic regression

	Sig.	Exp(B)	95% CI	
			Lower	Upper
Age	0.196	1.105	0.95	1.285
Limb				
Right	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Left	0.644	0.799	0.308	2.073
Both	0.645	1.339	0.386	4.642
Foot posture				
Neutral (Right)	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Pronation (Right)	0.648	0.454	0.015	13.44
Supination (Right)	0.717	0.569	0.027	11.989
Neutral (Left)	REF	REF	REF	REF
Pronation (Left)	0.127	10.198	0.515	201.868
Supination (Left)	0.566	2.303	0.133	39.861
Previous history				
No history	REFERENCE	REFERENCE	REFERENCE	REFERENCE
History of injury	0.039	2.396	1.045	5.497

The intrinsic risk factors above are not predictors of ankle and foot injury.

4.6.2 Extrinsic risk factors

The extrinsic risk factors evaluated in this study are playing ground, time of injury-training or match, playing position, ankle protection.

4.6.2.1 Type of playing ground

All the players who participated in this study used all the three grounds (dirt ground, artificial turf and grass) for either training or match. As shown in figure 4.4, 22 (43%) got injured while playing on dirt ground, 21(41%) on grass and 8(15.7%) on artificial turf.

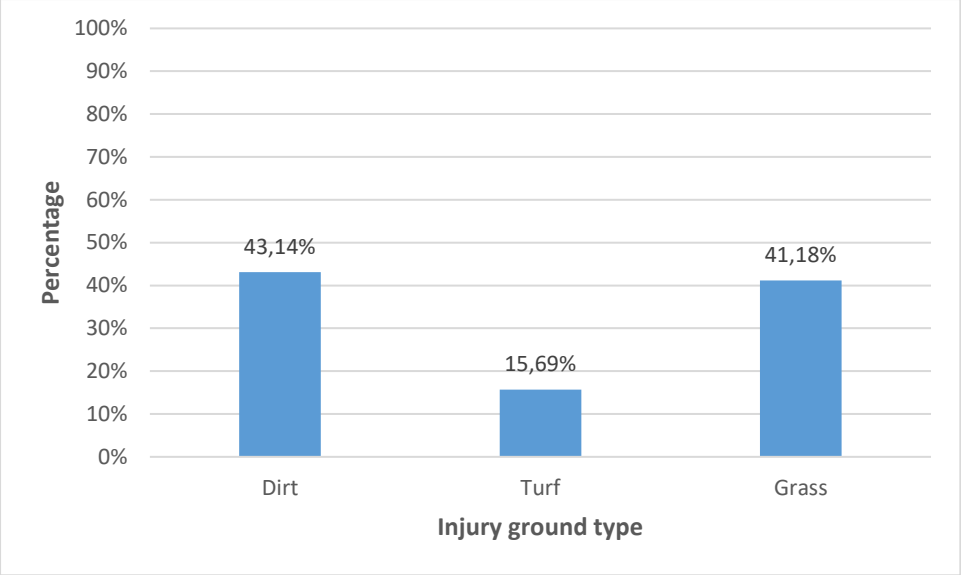

Figure 4.4Type of playing ground

4.6.2.2 Time of injury- training or match

Figure 4.5 below shows that 26 (51%) got injured during training and 25 (49%) got injured during the match.

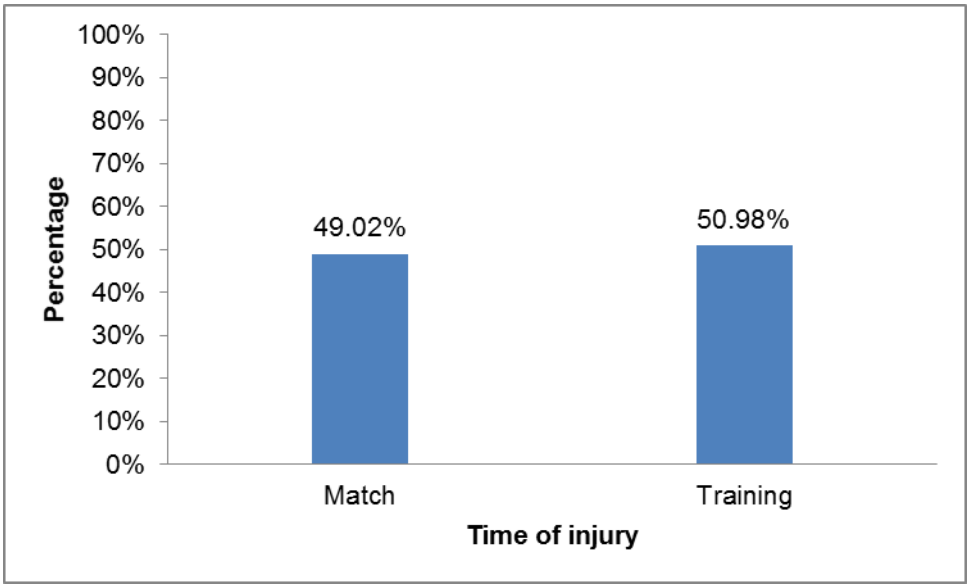

Figure 4.5Training vs match

4.6.2.3 Playing position

Table 4.16 illustrates the different playing positions and the difference between those with and those without injuries.

Table 4.16 Playing position vs the prevalence of an ankle and foot injury

Prevalence	Goalkeeper n (%)	Defender n (%)	Midfielder n (%)	Striker n (%)	Total n (%)	Fischer's exact
Yes	3 (2.75)	18 (16.51)	26 (23.85)	4 (3.67)	51 (46.79)	0.02
No	11 (10.09)	12 (11)	22 (20.18)	12 (11)	58 (53.21)	

As shown in the table 4.16, midfielders were most injured (23.85%) whereas goalkeepers were the least injured (2.75%). There is significant association between playing position and injury (p= 0.02).

Table 4.17 Univariate regression predicting ankle and foot injury

	Sig.	Exp(B)	95% C.I. for EXP(B)	
			Lower	Upper
Goalkeeper	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Defender	0.02	5.50	1.26	23.94
Midfielder	0.04	4.33	1.07	17.52
Striker	0.82	1.22	0.22	6.73

The odds ratio for defenders to have ankle and foot injuries when compared to goalkeepers is 5.5 while the odds ratio for strikers to have ankle and foot injuries when compared to goalkeepers is 1.22.

4.6.2.4 Use of preventive measures

The relationship between the use of ankle protection and ankle and foot injury is illustrated in table 4.18.

Table 4.18 Use of ankle protection vs ankle and foot injury (n=109)

	Use of protection, n (%)		
Presence of injury	No	Yes	Total
Yes	18 (16.51)	33 (30.28)	51 (46.79)
No	26 (23.85)	32 (29.35)	58 (53.21)
Total	44	65	

Majority of players who reported the use of ankle protection had ankle and foot injury (30.28%) as compared to 29.35% who did not use ankle protection and had no ankle and foot injury.

Table 4.19 Binary logistic regression predicting ankle and foot injury

	Sig.	Exp(B)	95% C.I for EXP(B)	
Use of protection			Lower	Upper
yes	REFERENCE	REFERENCE	REFERENCE	REFERENCE
no	0.312	1.49	0.688	3.227

Table 4.19 shows that the use of ankle protection is not a predictor of ankle and foot injury.

4.6.2.5 Playing time and match history

Table 4.20 shows the number of years playing football (experience) and the number of matches played in half a season in relation to injuries.

Table 4.20 Playing time and match history (n=109)

	Pl Without injury Median (IQR)	Injured Median (IQR)	Mann U Whitney	p-value
Playing years	6 (5-10)	7 (5-9)	1304.5	0.36
Number of games played at half season	14 (7-20)	12.5 (8.75-28.5)	1253.5	0.28

The median playing years for players with injury (7 years) is more than the median playing years of players without injury (6 years). Players with least number of matches (median 12.5) reported presence of ankle and foot injury.

Table 4.21 Univariate regression measuring the number of years playing football as a predictor for an ankle injury.

	Sig.	Exp(B)	95% C.I. for EXP(B)	
			Lower	Upper
Play Years	0.78	1.016	0.908	1.138

The table 4.21 shows that the number of years playing football (experience) is not a predictor of ankle and foot injury.

Table 4.22 Univariate regression measuring the number of games played as a predictor for an ankle injury.

	Sig.	Exp(B)	95% C.I. for EXP(B)	
			Lower	Upper
Number of games played	0.226	1.025	0.985	1.067

Table 4.22 shows that the number of games played is not a predictor of an ankle and foot injury.

Table 4.23 Multivariate binary logistic regression for extrinsic risk factors

	Sig.	Exp(B)	95% C.I. for EXP(B)	
			Lower	Upper
No ankle protection	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Use of ankle protection	0.35	1.49	0.65	3.41
Position				
Goalkeeper	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Defender	0.04	4.75	1.05	21.50
Midfielder	0.04	4.41	1.08	18.01
Striker	0.76	1.31	0.23	7.30
Years of play	0.87	0.99	0.86	1.13
Number of games played	0.48	1.02	0.97	1.07

None of the extrinsic risk factors is a predictor for ankle and foot injury.

4.7 Summary of risk factors

Multivariate regression for all risk factors is illustrated in table 4.24

Table 4.24 Multivariate regression for intrinsic and extrinsic risk factors

	Sig.	Exp (B)	95% CI	
			Lower	Upper
Ankle protection				
No ankle protection	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Use ankle protection	0.41	1.49	0.58	3.83
Playing position				
Goalkeeper	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Defender	0.02	7.73	1.50	39.83
Midfielder	0.03	5.46	1.22	24.47
Striker	0.63	1.60	0.24	10.75
Years of play	0.75	0.97	0.80	1.18
Number of games played	0.32	1.03	0.97	1.10
Age	0.73	1.05	0.81	1.36
Limb				
Right	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Left	0.44	0.66	0.23	1.90
Both	0.92	1.07	0.28	4.17
Previous injury				
No previous injury	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Previous injury	0.04	2.66	1.04	6.80
Foot posture				
Neutral (Right)	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Pronation (Right)	0.52	0.30	0.01	11.54

Supination (Right)	0.76	0.60	0.02	16.58
Neutral (Left)	REFERENCE	REFERENCE	REFERENCE	REFERENCE
Pronation (Left)	0.13	13.04	0.45	374.72
Supination (Left)	0.78	1.59	0.06	40.35

On multivariate regression, playing position and previous injury are predictors of ankle and foot injury. Limb dominance, foot posture, age, number of years playing football, number of games played and use of ankle protection are not predictors of ankle and foot injuries.

4.8 Section E: Foot and ankle outcome score

This section presents the results for the extent of ankle and foot symptoms of pain experienced by players and the association between ankle and foot injury and difficulty with activities of daily living.

Table 4.25 illustrates the results of the foot and ankle outcome score. The outcome score has five sections being symptoms of pain, pain, activities of daily living, sports and recreation and quality of life.

Table 4.25 Foot and ankle outcome score subscales

Foot and ankle outcome measure	**Median (Interquartile range)**	**Mean (SD)**	**95% CI**
Pain	80.56 (69.44 – 88.89)	-	74.7 – 82.49
Symptoms of pain	85.71 (78.57 – 89.29)	-	79.51 – 85.48
Activities of daily living	94.12 (83.92 – 98.53)	-	80.02 – 93.57
Sports and recreation	-	63.04 (22.47)	56.72 – 69.36
Quality of life	75 (56.25 – 87.50)	-	67.23-78.12

Table 4.25 shows that the ankle and foot injury did not affect activities of daily living of majority of the players (median 94.12, IQR 83.92-98.53).

Correlation between the subscales of the ankle and foot outcome score

The Spearman correlation coefficient was used to measure the relationship between the foot and ankle outcome score subscale as shown in Table 4.26.

Table 4.26 Correlation analysis between the ankle and foot outcome subscales

Spearman correlation	Pain $r_s\ (p-value)$	Symptom $r_s\ (p-value)$	Activities of daily living $r_s\ (p-value)$	Sport and recreation $r_s\ (p-value)$	Quality of life $r_s\ (p-value)$
Pain	1	-	-	-	-
Symptoms of pain	0.52 (0.00)	1	-	-	-
Activities of daily living	0.74 (0.00)	0.40 (0.00)	1	-	-
Sports and recreation	0.35 (0.01)	0.28 (0.05)	0.44 (0.00)	1	-
Quality of life	0.56 (0.00)	0.40 (0.00)	0.57 (0.00)	0.74 (0.00)	1

There was strong positive significant correlation between pain and activities of daily living ($r_{s=}0.74, p-value = 0.00$). There as a weak significant correlation between pain and sports and recreation ($r_{s=}0.35, p-value = 0.00$).

5 CHAPTER FIVE: DISCUSSION

5.1 Introduction

The aim of this study was to determine the prevalence of ankle and foot injuries and their effect on activity and function among premiere league soccer players in Gaborone. In this chapter, results of study are discussed based on the objectives of the study.

5.2 Demographic data

There were 109 football players who participated in this study. The age of the football players in the current study ranged between 18-32 years which is similar to the age range in other studies (Eirale et al., 2013, Omoniyi et al., 2016, Naidoo, 2007). The median average age for the players was 24 years. Eirale et al. (2013) investigated the incidence, characteristics and patterns of football injuries at club level in Qatar and found the mean age for the players slightly higher (28.4 years) than the average age in the current study. Similarly, Naidoo (2007) looked at the epidemiology of soccer injuries of professional soccer team in South Africa reported a mean age of 23.77 which is similar to the findings of this study. The age range shows that there is a mixture of young and old players therefore both age categories should be considered when coming up with injury prevention strategies to ensure an injury free soccer career.

Regarding the mean number of soccer playing time, the average of playing time was 7 matches in the current study. This was lower than the figure reported in a similar study by Archary (2008). Archary (2008) looked at a profile of soccer injuries in an amateur indoor and outdoor league in Durban South Africa and reported mean number of playing time as 12 matches. The possible reason for the difference could be that most players in the current study (63%) belong to the 18-24 age group and these players lacked experience as most of them (62%) belonged to the 1-7 playing years category. Soccer playing time should be considered when developing an injury prevention strategy.

Most of the players were midfielders (45%), defenders (28.4%), strikers (13.8%) and lastly goalkeepers (12.8%). Similar profile was reported in two studies based in South Africa (Naidoo, 2007, Jacobs and Van Den Berg, 2012). The high number of midfielders may suggest that in a game of football majority of players are distributed

in the middle of the playing field. Therefore, when developing an injury prevention programme, it is vital to consider the position of the soccer player to minimise the occurrence of injury.

5.3 Prevalence of injury

Several studies on the prevalence of ankle and foot injuries have reported a lower prevalence rate of injury. In English male professional football, Jones et al. (2019) reported 13% prevalence of ankle injury and 4% foot injury prevalence. Similarly, a study by Naidoo (2007) On the epidemiology of soccer injuries sustained in a season of a professional soccer team in South Africa reported 18.6% ankle injury prevalence. On the contrary, this current study found a higher prevalence (46.8%) of ankle and foot injury among premiere league footballers in Gaborone. The differences in the prevalence could be due to the different study designs used and how the concept of injury is defined (Naidoo, 2007, Jones et al., 2019) . For example, the current study used a cross-sectional study design whereas Naidoo (2007) utilised a longitudinal study design. On the same note, the current study recorded injuries that occurred in half a season whilst Naidoo (2007) recorded injuries for the entire soccer season.

Nevertheless, the prevalence of ankle and foot injuries in this study was high. It is unsurprising that the prevalence of ankle and foot injuries was high as players use dirt ground more than any other ground and this type of ground has been reported to predispose players to injury (Azubuike and Okojie, 2009). Therefore, it is essential that regular screening is conducted and prevention intervention are developed to minimize the occurrence of these ankle and foot injuries among these players.

5.4 Risk factors

There are various risk factors which predispose soccer players to ankle and foot injuries (Ekstrand et al., 2011, Halabchi et al., 2016, Henry et al., 2016). The risk factors are divided into intrinsic and extrinsic risk factors. Intrinsic risk factors are factors that are from within the body and extrinsic risk factors are factors that are outside the body (Barker et al., 1997).

5.4.1 Intrinsic risk factors

Intrinsic risk factors that have been reported to predispose soccer players to ankle and foot injury are; limb dominance, presence of previous injury, age and foot type.

Age is one of the key intrinsic risk factors. Injury at an early age has a negative long term effect on players as it predisposes them to posttraumatic osteo-arthritis (Buckwalter et al., 2013). Arnason et al. (2004) looked at the risk factors for injuries in football and reported that players in the injured group (mean 24.8) were significantly older than those who were uninjured (mean 23.4). They also reported that age was a significant predictor variable for an ankle injury (p-value 0.05). On the contrary, Hägglund et al. (2009) used the same age category as Arnason et al. (2004), but found no association of injury and increased age. In the current study, the median age of the soccer players with injury was found to be lower (23) than those without injury (24) but the difference was not statistically significant (p-value = 0.23). Age was not found to be a predictor for ankle and foot injury (p-value= 0.317). One cannot draw any conclusion regarding the relationship between age and injury. However, injury prevention at an early age is important to reduce musculoskeletal injuries and negative long-term effects brought about by the injury.

Foot morphology plays an important role in the effect of a relation between ground reaction force and rotational axes of the ankle and other lower limb joints (Beynnon et al., 2002). Various studies have been done to determine the relationship between foot posture and ankle and foot injury. In the current study, foot type was not found to be a predictor for ankle and foot injuries, however, players with pronated foot had more injuries than those with a neutral or supinated foot. The results of the current study concurred with the results of the study by Beynnon et al. (2002) who reported that foot type is not a risk factor for ankle injuries. In the current study the researcher carried out foot posture assessment when the player was in a static position standing on both feet away from play as per foot posture index manual. The classification system of foot type may be inadequate to identify abnormalities in foot biomechanics as it lacks specificity and sensitivity and the assessment is done when the player is standing barefoot and not during play where there is injury risk (Beynnon et al., 2002). Therefore, there is a need for a more sensitive tool that can be used to capture foot posture. Accurate knowledge of foot posture will assist in implementing prevention

strategies such as strengthening exercises determined by the foot posture and resultant biomechanical forces that need counteracting.

A previous ankle sprain is one of the most studied risk factors in the literature (Beynnon et al., 2002). Hägglund et al. (2006) and Engebretsen et al. (2010) reported previous ankle sprain as a significant risk factor for a new ankle sprain. The results of the current study also found a significant association between history of previous injury and current injury (p-value 0.02). An injury disrupts ligament by compromising biomechanical stabiliser and also results in ankle partial differentiation (Beynnon et al., 2002). Previous ankle injury results in fibrosis and adhesions which can decrease ankle range of motion and limiting function (Caine et al., 2008). Other factors that can determine the condition of joint post-injury are the type of rehabilitation offered, compliance of the patient with the rehabilitation program and whether or not there was adequate recovery post-injury (Beynnon et al., 2002). Thus, to fully understand the impact of previous ankle and foot injury as a risk factor it is essential to explore the type of rehabilitation offered post injury and compliance to the rehabilitation.

High demand activities may place the ankle of the dominant leg at risk of injury by increasing frequency and magnitude of moment on the ankle (Beynnon et al., 2002). In contrast, Fousekis et al. (2012) looked at intrinsic risk factors of non-contact ankle sprains in professional soccer players and reported that limb dominance does not predispose one to ankle injuries on the dominant leg. The analysis of the study showed that 52.9% non-contact ankle sprains occurred in the non-dominant leg while 17.6% occurred in the dominant leg and 29.5% were mixed footed injuries. The current study also found that limb dominance was not a significant risk factor for ankle and foot injuries (p value=0.77). In players with right dominant leg, there was an equal distribution of injury on those with and those without injury whereas in left dominant leg players, those with injury were more than those without injury. There is need for more studies to be conducted in order to establish the role of limb dominance as a risk factor for ankle and foot injuries.

5.4.2 Extrinsic risk factors

Extrinsic factors that have been reported to predispose soccer players to ankle and foot injury are type of playing ground; use of protective equipment; playing position; skill level and level of competition.

It has been proposed that soccer players with highest match exposure have fewer injuries (Arnason et al., 1996). A contradictory report was made by Arnason et al. (2004) who looked at risk factors in football. The results of the study showed that soccer players who had higher match exposure (mean 16.3 matches) were more injured as compared to those with lower match exposure (mean 12.4 matches). The results of the current study revealed that soccer players who participated in more matches (median 14 matches) did not show a higher injury incidence than those who participated in fewer matches (median12.5 matches). The number of matches played was found not to be a predictor for ankle and foot injury (p-vale=0.226). Although, the number of matches played was not a predictor of ankle and foot injury, care must be taken to avoid overloading soccer players with more matches as this may predispose them to injuries.

Experience (playing years) has been reported in the literature as a risk factor. Östenberg and Roos (2000) looked at the injury risk factors in female European football and reported that the injured soccer players had more experience (mean 13.8) than those without injury (11.5) (p-value=0.02). The current study revealed similar findings. The group with injuries had played football longer (median 14 years) than the group without injuries (median12.5 years) but the difference between the two groups was not significant (p-value=0.28). Furthermore, the analysis on univariate regression showed that the number of playing years is not a predictor of ankle and foot injury (p-value=0.78). The longer the individual plays football the more susceptible he/she is to injury as the longer playing years may result in possible repetitive strain injury.

The occurrence of injury during a match or training sessions is still not clearly understood. Ekstrand et al. (2011) looked at injury incidence and injury patterns in professional football and reported a significantly higher number of injuries during matches (57%) than during training sessions (43%). A cohort study on the epidemiology of injury in professional football players also showed a higher injury incidence during matches (24.29 per 1000h) as compared to training (6.84 per 1000h)

(Jones et al., 2019). The current study found contradictory results to the ones reported by Ekstrand et al. (2011) and Jones et al. (2019). The prevalence of injury was higher during training sessions (50.98%) than during matches (49.02%) though the difference was not significant. One possible reason could be the different ground fields during training and match sessions. The teams use dirt ground during training sessions and grass field than artificial turf during match session. The grass field is usually dry and uneven which makes it not much different from the dirt ground. This points to the need to advocate for better soccer fields to minimize the occurrence of soccer related injuries.

The condition of the playing ground and the influence that the weather has on the playing ground have been noted to have an effect on injury occurrence. In this study, most of the players (43%) got injured while using a dirt ground, while 41% got injured on the grass field. Similar reports have been reported in other studies (Azubuike and Okojie, 2009). Azubuike and Okojie (2009) reported 81.4% of soccer related injuries occurred on a ground that was either hard or dry. The study also reported a high number of injuries (78.9%) that occurred on hot and sunny conditions while the rest (20.1%) occurring on rainy or cold weather conditions. The conditions of the playing ground have been shown to have a negative impact on soccer players as it predisposes them to injury. It is therefore important to advocate for better management of the playing field as well as advocacy on the development of policies on the care of playing field in order to reduce the prevalence of injuries.

Ankle taping has been postulated to enhance proprioception in an injured ankle joint and also, restricts inversion angles effectively and significantly by lowering inversion velocity (Osborne and Rizzo Jr, 2003). The results of the current study indicated that most players use either ankle brace or taping to protect their ankles during play. Though most players reported the use of ankle protection, a high number of injuries was also reported amongst these players. These findings concurred with the study by Tyler et al. (2006) reporting increased injury incidence in those players using ankle brace or tape. The high injury rate in both these studies could be the type of brace used or inconsistent or incorrect use of ankle protection during training and matches sessions. Thus, education on the correct usage of bracing and taping as reinforcement and protective measure must be conducted continually to minimize the occurrence of soccer related injuries amongst soccer players.

The position of play has been associated with the risk of incurring ankle and foot injury. Kofotolis et al. (2007) reported the lowest injury rate for goalkeepers (2.15%). Goalkeepers were found to have the lowest injury rate (5.88%) among players assessed in our study. Kofotolis et al. (2007) further reported considerable higher injury rate for defenders (42.4%) as compared to midfielders (32.3%) and strikers (20.8%). On the contrary, this study found a higher injury rate for midfielders (50.98%) as compared to defenders (35.29%) and strikers (7.84%). Mtshali et al. (2009) reported an association between player position and point prevalence of injury. The study further reported that midfielders incurred 67% toe and foot injuries as compared to other playing positions and they were the most likely to have foot and toe injuries. The reason for the high injury rate in the middle field may be attributed to the style of play as most players in the middle field are usually more defensive as they prevent the ball from getting into the 18-yard box.

5.5 Foot and ankle outcome score

Injury to the ankle joint can result in an acute as well as chronic ankle disability. The resulting disability can either be functional instability or lead to a late degenerative changes (Ekstrand and Tropp, 1990). Functional instability is closely associated with stiffness, pain and swelling and usually the two outcomes happen together (Kannus and Renstrom, 1991).

5.5.1 Presence of pain and symptoms of pain

Development of residual symptoms such as oedema, the feeling of giving way, pain and re-injuries have been attributed to mechanical instability of an ankle joint (Kannus and Renstrom, 1991). Regarding pain 45.1% of injured players reported having pain which ranged from mild to severe. This is similar to the findings reported in the study by Anandacoomarasamy and Barnsley (2005) on the number of patients presenting with long term symptoms after incurring ankle sprain in sports. The study reported that 14 patients (74%) presented with at least 1 residual symptom 1.5-4 years after injury, pain (47%), instability (47%) and weakness (47%) with the highest prevalence rate. The presence of pain can limit functional activity and restrict participation in soccer related activities. Adequate rehabilitation should be emphasised by coaches and medical personnel in order to manage residual symptoms.

5.5.2 Activities of daily living

Moderate to severe residual symptoms limit activities of daily living and restricts participation in sporting activities. Hiller et al. (2012) reported that most of the participants (more than 60%) reported modified physical activity due to the presence of musculoskeletal disorders. On the contrary, most of the soccer players in this study (84%) reported that their ankle and foot injury was not interfering with their activities of daily living while 7(14%) reported mild interference. However, there was a strong positive correlation between pain and activities of daily living $(r_{s=}0.35, p-value = 0.00)$. Possible reason for the a small percentage reporting mild activity limitation due ankle and foot injuries could be due to soccer players fearing possible future career outcome. Thus, a qualitative exploration on the impact of residual symptoms such as pain is indicated.

Residual symptoms have been noted to have an effect on athletic performance. Most of the soccer players (39.2%), ankle and foot injury had a moderate effect on their participation in sports and only 3.9% reported being extremely affected by the injury. The results of the current study also showed a weak correlation between pain and sports and recreation $(r_{s=}0.35, p-value = 0.00)$. Similar reports were made by Anandacoomarasamy and Barnsley (2005). Although their study reported a high rate of presence of residual symptoms (74%), only 3 athletes were persistently impaired by the symptoms which resulted in two of them changing to other sports and one completely leaving sports. For this reason, a comprehensive rehabilitation and proper medical care at club level should be encouraged to prevent players leaving soccer sports.

5.6 Conclusion

The age of the soccer players in the current study ranged between 18-32 years which is similar to the age range in other studies (Eirale et al., 2013, Omoniyi et al., 2016, Naidoo, 2007). Majority of the soccer players were midfielders (45%). Midfielders incurred more injuries than all playing positions. There are various risk factors (limb dominance, age, previous history, playing position, type of playing ground) that influence injury occurrence among football players. Knowledge of injury risk factors may help the team to establish preventative measures that are specific to them.

Residual symptoms such as pain have been reported to negatively affect activities of daily living and sports participation. Adequate rehabilitation should be emphasised by coaches and medical personnel in order to reduce residual symptoms.

6 CHAPTER SIX: CONCLUSION

6.1 Introduction

The main purpose of this research was to establish the prevalence of ankle and foot injuries, associated factors and the effect of injury on activities of daily living and sports amongst premiere league football players in Botswana. The results of this study were presented in detail in chapter four and discussed in chapter five. A summary of the results is discussed in this chapter, followed by future research recommendations and lastly, limitations of the study are presented.

6.2 Summary of the study

This study has shown that the prevalence of ankle and foot injuries is similar to existing literature (Naidoo, 2007, Jacobs and Van Den Berg, 2012, Jones et al., 2019) on epidemiological studies on ankle and foot injuries. Injuries were prevalent in the younger group of players indicating the need for education on injury prevention strategies in this age group.

Risk factors such as presence of the previous history of ankle and foot injury and playing position have been identified as predictors for ankle and foot injuries in the current study as there was a statistical significance between injury and the two risk factors. Understanding the risk factors can inform targeted injury prevention programmes.

Of the injuries that were reported, most of them seem to be minimal as soccer players were off-field for a short period of time. The injuries also had a minimal impact on activities of daily living and sports of individual soccer players as only a few of them reported being severely affected by their injury. It is suggested that stringent measures be put in place to curb the prevalence of ankle and foot injuries.

6.3 Implications

Players, team management and medical personnel in charge of teams should have a better understanding of injury risk factors to reduce the number of injuries. Knowledge of injury risk factors may help the team to establish preventative measures that are specific to them. The study results may also be used as a basis for the development

of an injury prevention intervention to address the identified risk factors. Lastly this study can be used to advocate for better training grounds for the soccer players in Gaborone.

6.4 Recommendations for further studies

- Also, there is a need for context-based studies to better identify other extrinsic injury risk factors such as training ground, in order to inform prevention strategies to reduce ankle and foot injuries.
- A prospective study of injury surveillance over a season be conducted to capture a true picture of the magnitude of injury burden.
- Develop an intervention study addressing the identified risk factors

.

6.5 Study limitations

- It is difficult to compare this study with previous studies as there is a difference in study design such as injury definition, level of play and injury reporting method.
- Since this was a self-administered survey, ankle and foot injuries were not graded.
- Ankle and foot injuries were not reported separately which made it difficult to establish the prevalence of each separately. This may be the reason for the high prevalence as most of the literature reviewed, they were looking at ankle and foot separately.
- The questionnaires did not capture playing hours and exposure time which limited calculation of injury incidence in the current study.
- The study did not address all risk factors for ankle and foot injuries.
- The current study was limited to Gaborone premiere league teams and it is suggested that a study involving all premiere league teams nationwide be conducted to improve validity.

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APPENDICES

Appendix A: Letter to the Premiere league office

Dear sir/madam

Re: REQUEST TO CONDUCT A STUDY IN PREMIERE LEAGUE TEAMS

My name is Kaelo Kgosiyang. I am a physiotherapy masters student at the university of Witwatersrand, Johannesburg.

This letter serves to request permission from your office to conduct a study in premiere league teams in Gaborone. The aim of the study is to determine the prevalence of ankle injuries and risk factors in premiere league football players in Gaborone. The objectives of the study are:

1. To determine the demographic profile of soccer players
2. To establish the prevalence of ankle injuries among premiere league players in Gaborone
3. To determine the intrinsic risk factors among football players in Gaborone
4. To determine the extrinsic risk factors among football players in Gaborone
5. To determine the factors associated with the presence of ankle injury
6. To describe the quality of life of players with an ankle injury

The results of this study shall determine if there is need to develop injury prevention strategies for premiere league teams. Upon completion of the study, the results of the study will be shared with your office and with the management of all the teams.

Yours sincerely

Kaelo Kgosiyang
+267 71869158/ +27 835526935
Email: kaerams@yahoo.com
Supervisors:
Hellen Myezwa: hellen.myezwa@wits.ac.za
Sonti Pilusa: sonti.pilusa@wits.ac.za

Appendix B: Letter to the team management

Dear sir/madam

Re: REQUEST TO CONDUCT A STUDY IN PREMIERE LEAGUE TEAMS

My name is Kaelo Kgosiyang. I am a physiotherapy masters student at the university of Witwatersrand, Johannesburg.

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The results of this study shall determine if there is need to develop injury prevention strategies for premiere league teams. Upon completion of the study, the results of the study will be shared with your office and with the management of all the teams.

Yours sincerely

Kaelo Kgosiyang
+267 71869158/ +27 835526935
Email: kaerams@yahoo.com
Supervisors:
Hellen Myezwa: hellen.myezwa@wits.ac.za
Sonti Pilusa: sonti.pilusa@wits.ac.za

Appendix C: Information sheet

Good day

My name is Kaelo Kgosiyang, I am currently studying masters degree in physiotherapy at the university of the Witwatersrand. I am conducting a study titled “the prevalence and risk factors of ankle injuries among premiere league footballers in Gaborone”.

The prevalence of ankle injury has been found to be common in the football player. However, there is no published data on the prevalence of ankle injury in Gaborone. The study is going to involve all the premiere league teams based in Gaborone, and it will take place within half of a season.

I would like to invite you to take part in this research.

Procedure

The researcher will visit the teams during their training hours. The aim of the study will be explained to the participants, the participants will be asked to sign the consent form if they are willing to participate. The participants will be asked to complete a short self-administered questionnaire. The questionnaire will take ten minutes to complete per participant. An assessment will be conducted by the researcher on the participants which will require them to take off their shoes in-order to check the foot posture. The foot assessment will take ten minutes per participant.

Potential risks involved

There are no physical or psychological risks involved in this study

Benefits involved

There are no direct benefits for taking part in this study. However, the results of this study will be a basis in developing injury prevention programmes for premiere league teams in Gaborone.

Rights of a participants

The participant has a right to refuse to take part in the study without any consequences. The participant can withdraw from the study at any time without any consequences. The responses will be anonymous and will only be used in this study without being traced back.

Contact details of the researcher

The participant will always be welcome to contact the researcher if there is any question on mobile number: +27835526935/+26771869158 or through email: kaerams@yahoo.com or contact the supervisors Professor Hellen Myezwa and Mrs Sonti Pilusa; Tel 011-717-3702. Questions concerning ethics of this research should be forwarded to the Chairperson of the ethics committee Prof P Cleaton Jones; Tel: 011-717-2700.

Appendix D: Consent form

I (name of player)…… ID…… hereby give consent to participate in a study titled “the prevalence and risk factors of ankle injuries among premiere league footballers in Gaborone”, in which assessment of my feet will be done. I further give consent to fill in the ankle injury questionnaire that will be given to me during the study period. I also agree to consider extending my co-operation to such further or alternative experimental measures as may be explained to me at the time of the study.

The nature and purpose of the study has been fully explained to me by the researcher (Kaelo Kgosiyang).

Date……. Signed…….. Subject……..

Appendix E: Ankle injury questionnaire

A. DEMOGRAPHIC DATA

Code ---------- Age -------

Limb dominance ---------- Position ----------

How long have u been playing in football? ----------

Training history ----------

Match history ----------

Did you get injured during training or match? ----------

Type of ground during injury (hard, turf, grass)? ----------

B. ANKLE PAIN

Symptoms

These questions should be answered thinking of your foot/ankle symptoms during the **last 5 months**.

S1. Do you have swelling in your foot/ankle?

Never Rarely Sometimes Often Always

S2. Do you feel grinding, hear clicking or any other type of noise when your foot/ankle moves?

Never Rarely Sometimes Often Always

S3. Does your foot/ankle catch or hang up when moving?

Never Rarely Sometimes Often Always

S4. Can you straighten your foot/ankle fully?

Always Often Sometimes Rarely Never

S5. Can you bend your foot/ankle fully?

Always Often Sometimes Rarely Never

Stiffness

The following questions concern the amount of joint stiffness you have experienced during the **last five months** in your foot/ankle. Stiffness is a sensation of restriction or slowness in the ease with which you move your joints.

S6. How severe is your foot/ankle stiffness after first wakening in the morning?

None Mild Moderate Severe Extreme

S7. How severe is your foot/ankle stiffness after sitting, lying or resting **later in the day**?

None Mild Moderate Severe Extreme

Pain

P1. How often do you experience foot/ankle pain?

Never Monthly Weekly Daily Always

What amount of foot/ankle pain have you experienced the **last five months** during the following activities?

P2. Twisting/pivoting on your foot/ankle

None Mild Moderate Severe Extreme

P3. Straightening foot/ankle fully

None Mild Moderate Severe Extreme

P4. Bending foot/ankle fully

None Mild Moderate Severe Extreme

P5. Walking on flat surface

None Mild Moderate Severe Extreme

P6. Going up or down stairs

None Mild Moderate Severe Extreme

P7. At night while in bed

None Mild Moderate Severe Extreme

P8. Sitting or lying

None Mild Moderate Severe Extreme

P9. Standing upright

None Mild Moderate Severe Extreme

Function, daily living

The following questions concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following activities please indicate the degree of difficulty you have experienced in the last 5 months due to your foot/ankle.

A1. Descending stairs

None Mild Moderate Severe Extreme

A2. Ascending stairs

None Mild Moderate Severe Extreme

For each of the following activities please indicate the degree of difficulty you have experienced in the last 5 months due to your foot/ankle.

A3. Rising from sitting

None Mild Moderate Severe Extreme

A4. Standing

None Mild Moderate Severe Extreme

A5. Bending to floor/pick up an object

None Mild Moderate Severe Extreme

A6. Walking on flat surface

None Mild Moderate Severe Extreme

A7. Getting in/out of car

None Mild Moderate Severe Extreme

A8. Going shopping

None Mild Moderate Severe Extreme

A9. Putting on socks/stockings

None Mild Moderate Severe Extreme

A10. Rising from bed

None Mild Moderate Severe Extreme

A11. Taking off socks/stockings

None Mild Moderate Severe Extreme

A12. Lying in bed (turning over, maintaining foot/ankle position)

None Mild Moderate Severe Extreme

A13. Getting in/out of bath

None Mild Moderate Severe Extreme

A14. Sitting

None Mild Moderate Severe Extreme

A15. Getting on/off toilet

None Mild Moderate Severe Extreme

For each of the following activities please indicate the degree of difficulty you have experienced in the last 5 months due to your foot/ankle.

A16. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc)

None Mild Moderate Severe Extreme

A17. Light domestic duties (cooking, dusting, etc)

None Mild Moderate Severe Extreme

Function, sports and recreational activities

The following questions concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the last 5 months due to your foot/ankle.

SP1. Squatting

None Mild Moderate Severe Extreme

SP2. Running

None Mild Moderate Severe Extreme

SP3. Jumping

None Mild Moderate Severe Extreme

SP4. Twisting/pivoting on your injured foot/ankle

None Mild Moderate Severe Extreme

SP5. Kneeling

None Mild Moderate Severe Extreme

Quality of Life

Q1. How often are you aware of your foot/ankle problem?

Never Monthly Weekly Daily Constantly

Q2. Have you modified your life style to avoid potentially damaging activities to your foot/ankle?

Not at all Mildly Moderately Severely Totally

Q3. How much are you troubled with lack of confidence in your foot/ankle?

Not at all Mildly Moderately Severely Extremely

Q4. In general, how much difficulty do you have with your foot/ankle?

None Mild Moderate Severe Extreme

Thank you very much for completing all the questions in this questionnaire.

FAOS Manual scoring sheet

Instructions:

Assign the following scores to the boxes!

None	Mild	Moderate	Severe	Extreme
0	1	2	3	4

Missing data. If a mark is placed outside a box, the closest box is chosen. If two boxes are marked, that which indicated the more severe problems is chosen. Missing data are treated as such; one or two missing values are substituted with the average value for that subscale. If more than two items are omitted, the response is considered invalid and no subscale score is calculated.

Sum up the total score of each subscale and divide by the possible maximum score for the scale. Traditionally in orthopedics, 100 indicates no problems and 0 indicates extreme problems. The normalized score is transformed to meet this standard. Please use the formulas provided for each subscale!

1. PAIN $100 - \frac{\text{Total score P1-P9} \times 100}{36} = 100 - \frac{\_\_\_\_\_}{36} = \_\_\_\_\_$

2. SYMPTOMS $100 - \frac{\text{Total score S1-S7} \times 100}{28} = 100 - \frac{\_\_\_\_\_}{28} = \_\_\_\_\_$

3. ADL $100 - \frac{\text{Total score A1-A17} \times 100}{68} = 100 - \frac{\_\_\_\_\_}{68} = \_\_\_\_\_$

4. SPORT&REC $100 - \frac{\text{Total score SP1-SP5} \times 100}{20} = 100 - \frac{\_\_\_\_\_}{20} = \_\_\_\_\_$

5.QOL $100 - \frac{\text{Total score Q1-Q4} \times 100}{16} = 100 - \frac{\_\_\_\_\_}{16} = \_\_\_\_\_$

Appendix F: Information on previous ankle injury

LEFT ANKLE

Number of previous acute ankle injuries (sprains):

□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ >5

RIGHT ANKLE

Number of previous acute ankle injuries (sprains):

□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ >5

If you answered ”0” above, skip the next 3 questions regarding the left ankle and continue at the next section, 1B.

LEFT

Time since most recent injury:

□ 0-6 months □ 6-12 months □ 1-2 y □ >2 y

RIGHT

Time since most recent injury:

□ 0-6 months □ 6-12 months □ 1-2 y □ >2 y

LEFT

For how long were you unable to fully play/train?

□ 1-3 days □ 4-7 days □ 1-4 weeks □ >4 weeks

RIGHT

For how long were you unable to fully play/train?

□ 1-3 days □ 4-7 days □ 1-4 weeks □ >4 weeks

LEFT

Do you usually use any form of ankle protection?

□ No

□ Tape If tape: □ Always □ Sometimes

□ Orthosis/brace

If orthosis: Always □ Sometimes

RIGHT

Do you usually use any form of ankle protection?

□ No

□ Tape If tape: □ Always □ Sometimes

□ Orthosis/brace

If orthosis: Always □ Sometimes

Appendix G: The foot posture index (FPI-6)

TEST	**RIGHT FOOT SCORE -2 TO +2**	**LEFT FOOT SCORE -2 TO +2**
Talar head palpation		
Supra and infra lateral malleolar curvature		
Calcaneal frontal plane position		
Bulging in the region of the talo-navicular joint		
Height and congruence of the medial longitudinal arch		
Abduction/adduction of the forefoot on the rear-foot		

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG

R14/49 Ms K Kgosiyang

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M170854

NAME: Ms K Kgosiyang
(Principal Investigator)
DEPARTMENT: School of Therapeutic Sciences
Department of Physiotherapy
Medical School

PROJECT TITLE: The prevalence and risk factors of ankle injury amongst Premier League footballers in Gaborone

DATE CONSIDERED: 25/08/2017

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Prof H Myezwa and Ms S Pilusa

APPROVED BY: _____
Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 27/11/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially reviewed in **August** and will therefore be due in the month of **August** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

_____ _____
Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES